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THE NEW TARIFF.

There seems reasonable ground for expecting the new tariff bill to become law this week. At any rate, settlement of the subject cannot be deferred much longer, and its removal as a cause of commercial anxiety and disturbance will be welcomed. An article elsewhere in this issue summarizes the situation from the electrical standpoint, and enumerates the various items affecting the electrical industries and the new rates of duties. In a general way the manufacturers should be satisfied, and probably are, as their interests have in the main been conserved, except where perhaps the incidence of a new rate of duty may be found to affect the price on importation of some raw material, as in the case of mica and some of the rarer metals used in incandescent lamp filaments. To this extent also the welfare of the electrical consumer is prejudiced, because any greater element of cost tends to make it harder to give service. The controversy over certain kinds of lighting carbons is a case in point, but the most singular fact in that affair is the absence of complaint from the users. There are about 6000 central stations in this country and probably not less than 50,000 isolated plants furnishing arc lighting; but if any urgent protest has come from this quarter we have failed to learn of it. Indeed, the course of the tariff agitation and of hearings at Washington has been very free from participation by the consumers of electrical goods and apparatus. This may be apathy and indifference, or a feeling that it would do no good anyhow, but the fact remains; and the one thing now left to us is to take the tariff as it stands and make the best of it. In some quarters there appears to be a feeling that prolonged finality is wanting to the present action. That would be rather unfortunate. It may be taken as axiomatic that even a very bad tariff cannot do as much harm to the national welfare as a tariff tinkered every year in the search for perfection.

CENTRAL STATIONS AND AUTOMOBILES.

In this issue will be found an exhaustive summary of the conditions pertaining to the present relationships between central stations and the electric automobile. As the result of considerable time and expense devoted to a canvass of the central-station industry during the past two months, we have secured returns from over 1500 plants giving data as to what they have or have not done, or what they intend to do in connection with charging electric vehicles. We believe that the data obtained will be surprising and very encouraging to all who feel that here is a most profitable field of business to be developed; and that it will be seen how large the opportunity is. There are some limitations, of course. They were known before. It is not wise to push the use of such machines in regions not adapted for them; but, after all, those regions are restricted in number and extent; and the same remarks would apply to other pieces of electrical apparatus. We make bold to say that under ordinary conditions, the thought and attention now bestowed by an average central station on fans and flat-

irons, if devoted equally to electric vehicles, would bring a large accession of income and profit. It is amazing that so many stations are not yet fully aroused to their opportunity in this respect, yet it will be seen from the article that 10,000 vehicles and an income of $500,000 a year from charging are conservative figures based on authentic statements from all parts of the country.

We are glad to note that the Edison Association at its coming convention will take up the subject; while it is understood that at the time of the New York Electrical Show in October, the National Electric Light Association will again devote attention to it and will hold a special conference for that purpose. The plan must be heartily approved, for it would be hard to find a better means of improving "off the peak" load. Central stations have yet to study this great subject as it deserves, and in particular to learn the infinite possibilities of commercial electrics. There are examples that show not only what they can earn for stations, but what they can earn for their owners. Of course, the question of rates is involved, but here again it is a class of service drawing from the mains at dull hours and tending to even up the load in such a way as to bring a lower range of cost of energy into sight, with larger profit to the plant. In too many instances, hitherto, the business has been discouraged by high rates, examples of which we give; but it is ideally of a class that can be fostered and nourished by a moderate scale.

Another point we would like to emphasize is the necessity for central stations themselves to "get into the game." It is not worthy of a modern, progressive, up-to-date company—it is a contradiction of those terms—to be using horse vehicles when it can use electrics not only as examples, but with actual and notable economy. Any serious investigation will establish that fact, for most of the towns and cities of the country. We trust that our readers will give the matter such study, which they can best do by getting some machines themselves and putting them at once in steady employment on the various classes of work that a station of any size needs to have done regularly and frequently. They will also learn in the same way the features of care and inspection that underlie success, and the absence of which are to blame for much of the ill success of electrics in the past. The mere fact that 5-ton trucks six years old are to-day still doing splendid service daily and earning a known income of $30 to $50 a day, tells the story of what a little care and intelligence will do.

The Blessed Noiselessness of the Electric Automobile.

If the noise of machinery means waste, as engineers contend, the ordinary gasoline automobile must be a wasteful device indeed. In the campaign against the noise of city streets the gasoline car is often a conspicuous offender, and it contrasts most unfavorably with the latest types of electric vehicles, which are almost noiseless. Imagine a darkened upper room in a city house in which a father is anxiously regarding a sick child. The curtains are drawn, but the windows must be left open to admit the summer air. The doctor says that the little sufferer must have rest and quiet, and the parents are doing their best to secure this condition without removing their little one from the comforts of home. There are flowers in the room, and the restful hum of an electric fan is heard. The child has fallen into a troubled sleep, and the father is regarding her anxiously. Suddenly, whir-r-r-r, chug, chug, chug—the distracting noise of a big gasoline automobile is heard outside. It sounds like an explosion and is continued for some time. The patient jumps up with a start; its dearly bought rest has vanished, and slow tears course down the cheeks of the child. The father has an impulse to tear that machine into a thousand fragments if he could get at it. This is no imaginary picture, but fact.

No such charge as this can be brought against the electric machine. "Joy riders" make no use of the electric vehicle. The speed mania does not seize hold of those who manage the safe and sane electric car. The latter does not drip gasoline on the street, neither is it characterized by an offensive odor. Quietly, steadily, but with strength and power, electricity does its work whether in propelling the carriage which a woman or even a child may operate, or driving the attractive delivery wagon or the heavy truck. The opprobrium which attaches to the reckless driving of automobiles is directed almost entirely against the gasoline cars, and rightly so, for very few accidents are to be attributed to the easily controlled machines of the electric type. In a few places in this country automobiles are forbidden the privileges of the street within municipal limits; but it will be well for the exasperated city authorities to make a distinction in favor of the electric vehicle, for it is not that type of car that has brought reproach on automobilism.

Cost of Municipal Street Lighting.

It is gratifying to observe that more scientific and intelligent ideas relating to the cost of street lighting by electric arc lamps are entertained by municipal bodies than has been the case in former years. An illustration is furnished by the report just issued by the Department of Electricity of the City of Chicago, where Mr. William Carroll is city electrician. This report covers the year 1908, and it is conspicuous and interesting from the fact that an effort has been made, apparently, to arrive at the real or actual cost of electric street lamps owned and operated by the municipal corporation. Mr. Carroll places the "average cost of the operation and maintenance" of the 8602 lamps owned and operated by the city at $45.86 per year. He is careful to say, however, that this amount, while it includes all cash paid out for labor and material of all kinds, superintendence and office charges, does not include interest, depreciation, lost taxes, water rates, rent of the office used by the city electrician, rental of poles belonging to other companies nor the cost of work done by other branches of the city government which enter into the electric lighting service. The city electrician refers to the "Arnold and Young report" presented to the Mayor during the year on the cost of Chicago's municipal electric lamps and, without expressing approval or disapproval of this report, he recognizes the great ability, reputation and fairness of the engineers and accountants who made it, and presents a supplementary table in which he adds to the "actual cash cost" charges for water, rentals, office rent, taxes, insurance, depreciation, interest and proportion of other department salaries as being part of the true cost of operating the municipal plant. These various charges amount to a total of $28.26 per lamp. This, added to the "actual cash cost," gives a "grand total" of $74.12 per lamp. It is interesting

to compare this actual cost of municipal street lamps with the average annual rental of lamps obtained from the central-station company, which was $78.75 for the year and is now $75 a year. It will be seen that the city's cost of producing the light for each arc lamp is but a trifle less than that afforded by the central-station company, and it is indeed pleasing to record the fact that, after these many years, municipal lighting authorities have been educated to the point of making public the actual cost of street arc lighting.

In the past similar figures were not given, partly because the municipal authorities wanted to make a favorable showing, but largely because they were not known. Now more intelligent accounting is done by municipal bodies as well as by private concerns; there have been enlightenment and advancement all along the line, and it is evident that the cost to the city of municipal electric lighting was much larger than was strenuously claimed in former years. The point is that the city ought not to make misleading statements about the cost of this lighting, even though these mistaken figures are put forth from ignorance rather than by design. It is to be remarked, however, that central-station companies themselves have learned and are learning a great deal on the intricate subject of electrical accounting while the controversy in relation to municipal ownership has been going on. Both sides to this controversy, or former controversy, now seem to admit that the other has arguments which are entitled to a respectful hearing, and it is pleasing to observe that the old asperities have passed away to a large extent.

CONSOLIDATION OF SMALL CENTRAL STATIONS.

The economic advantages to be gained from the consolidation of small central stations under one management, and where possible with one source of supply, are receiving increased recognition from year to year and at the present time are probably receiving more serious consideration by small central-station managers than at any previous period in the history of the industry. At the N. E. L. A. convention in June the point emphasized above all others by no less authorities than Mr. Frank A. Vanderlip and Mr. Samuel Insull was the financial advantage of such consolidation. In a recent talk before the Electric Club at Chicago Mr. Harold Almert referred to the advantages to be obtained by such consolidations of small companies. The disadvantage under which the small company has always labored has been chiefly that the smallness of the enterprise has made it financially unattractive to engineers and business men of ability, who are able to find a more profitable market for their services in larger companies. The influence of this condition has been far-reaching. The management of such companies has frequently been placed in incompetent hands, which has made the profits uncertain, with the result that securities of such companies are not marketable except in the community in which they operate, and sometimes not even there. Mr. Almert also aptly explained the situation when he said that while large central stations are likely to suffer from over-capitalization, small central stations chronically suffer from under-capitalization. The small company usually starts out with enough local capital to build the power plant and take on a limited number of consumers. As the business grows and extensions are attempted which the original capital cannot take care of, the capital is not increased, but legitimate net earnings go back into the plant for extensions and nothing is taken out.

The two particular benefits to be obtained from the consolidation of a number of small central stations are: First, the possibility of attracting good men to manage and carry on the business; second, the favor with which securities of such a consolidation would be received by the general investing public in virtue of the better management and the fact that the investment is not dependent upon any one small community. With a number of consolidated plants it is also possible to put into practice systems of purchasing, bookkeeping and testing not possible in any one small company. As a general rule, both gross and net returns on well-managed plants in towns from 2000 to 10,000 are more than in larger cities. This is not due to low operating expenses, because the operating expenses of such plants are likely to be a higher percentage of the gross receipts than in the large plants. The investment per kilowatt rating for small towns, however, usually averages below that in large cities, which frequently more than compensates for the higher rate of interest and depreciation which must be figured on the small plants. Then, too, much higher and more expensive standards of construction must be maintained in large cities than in small towns, a fact which can only be appreciated by one who is frequently thrown in contact with work in both the large and small towns.

THE CONSERVATION OF FUEL.

The full utilization of the world's fuel supply implies as one of its most important prerequisites the effective use of the low-grade coals which form so considerable a proportion of the available total. To this end much money and effort have been spent, upon the whole to good purpose, and in particular the process of working up otherwise difficultly usable coal into briquettes has now risen to considerable importance. A recent paper furnishes considerable data upon the subject which are worthy of serious consideration. As a matter of fact, the briquette industry abroad is a large one. Germany has a yearly output of something like 15 million tons of coal briquettes, and even England, with her splendid resources in fuel close at hand, makes one and a half to two million tons of briquettes. In this way very valuable fuel, too small in its natural state to work well in any practicable furnace, is turned to account and by this amount waste of unreplaceable material is spared. Piles of coal briquettes are familiar adjuncts of Continental plants and are found an economical and convenient sort of fuel for use alone or in conjunction with the brown coals that are so prominent a feature in some parts of the Continent. The briquettes have a high thermal value, are easy to transport and to handle, and burn to great advantage.

Technically, the briquette industry involves some nice points, especially in the choice of the binder, which commonly makes up 5 or 6 per cent of the whole. Pitch and resin have proved the most satisfactory binders, upon the whole, especially when combined in the ratio of about three or four parts of the former to one of the latter. On general principles these binders are objectionable on the score of eventually uncertain supply, and perhaps in due season asphaltic residues of some sort may

replace them. But in spite of having to use pitch in the ordinary processes briquettes are not relatively an expensive fuel under favorable circumstances. Figures are given, in the paper referred to, for the cost of briquette making in an English plant of moderate equipment. The total, including everything, even interest and depreciation, figures up to a scant $2.35 per ton at the works. This is an encouraging figure and could doubtless be materially reduced in working on a big scale in this country. Perhaps the time is not quite ripe for the industry here, yet it is well worth considering seriously, especially with respect to some of the coals which do not bear transportation well and show abnormal waste. In addition to such processes the peat supply should be brought into use ere long. Peat has not generally a high thermal value, running even when compressed as low as 6000 lb.-Fahr. units per pound. Its weakest point practically seems to be its admixture as found with earthy material which is hard to separate. Now and then a really rich deposit of peat is found, but it tends to run irregularly, and is therefore very troublesome to manage. Yet in the aggregate the thermal value of the peat supply, like that of the lignite supply, is so huge that it is worthy of very persistent effort. Making briquettes of the waste coals best suited to such use, and working up the lignite and peat supplies, are important steps toward preserving the rapidly waning fuel supply.

The Proposed Corporation Tax.

At present writing it seems highly probable that a tax on the net earnings of corporations is likely to be incorporated in the revenue measures now under consideration. Such a tax, like the income tax, as we have already noted, would be almost certain to prove even more unpopular than most taxes. The revenue of the country has up to the present time been raised chiefly by methods of indirection. The sums required by the recent "billion-dollar Congresses" necessarily fall somewhat heavily upon the whole people of the country, but extracted as they are in small amounts, without the inquisitorial visits of the tax collector, they would hardly be felt were it possible to collect them, not merely at small expense to the Government, but at small expense to the consumer. In point of fact, as has been amply demonstrated during the discussion of the present tariff bill, a very small increase in duties means practically a very large increase in the cost of the commodity to the consumer. A complete disclosure of the devious methods by which a dollar increase in duties becomes $5 increase in price would be extremely interesting and might serve as a corrective of some of the abuses.

The present prosposal to tax the net income of corporations possesses both good and bad features, the bad on the whole predominating. A corporation tax bringing the financial vagaries of some corporate activity within the grip of the Government might perhaps indirectly serve a useful purpose. It would unquestionably be a nuisance for the honestly managed corporations which form the vast majority of the whole. On the other hand, it seems altogether probable that the dishonestly managed minority would succeed, under any form of law likely to be enacted, in dodging a considerable part of their responsibilities and shuffling the burden of taxation off their own shoulders. This was certainly the effect of the late unlamented income tax of a few years ago. In the same way there is every reason to expect that if a corporation tax is passed, net profits, from which alone dividends can properly be declared, might often fall off in a way very shocking to the champions of prosperity. What is worse, they are altogether likely to diminish in such a way as to bear heavily upon the ordinary investor.

Unless the recent lesson of the income tax be forgotten, it is altogether probable that in the case of the very corporations most in need of control the tax will affect dividends most severely, the net income divisible being reduced to the financial advantage of the insiders. Government supervision close enough to avoid this danger would have to be of extremely drastic character, so severe in fact as to be a serious burden to those honestly conducted business organizations that try to live up to the spirit of the law and to deal fairly both with their stockholders and with the Government. Without in the least excusing dishonesty, measures which put a premium upon it are morally objectionable. If corporations, as a revenue measure, must be taxed, some other method than taxation of net income would seem desirable. As has already been demonstrated, corporations as artificial persons have very valuable immunities which offer a valid excuse for a reasonable tax. It would seem, however, that if the Government desires to obtain its revenue simply and cheaply from the taxation of corporations the easiest process would be a small tax upon the nominal assets as represented by the capitalization. As a broad proposition of law, capital stock is supposed to be issued for actual values and theoretically represents the property of the corporation. The effect of such a tax would undoubtedly be salutary in punishing that stock watering which has been the vice of American finance. It would do little harm if many of the corporations in this country were compelled to reduce their stock to a point somewhere nearer its value; and even if the shrinkage were considerable, so that the revenues obtained from this source were greatly reduced, the tax in the long run would work to the benefit of the honest and conservative. But a tax put in such form as to hit merely the net income appears to the casual observer as an incentive to the most reprehensible kind of juggling with the books, and the same objection would apply broadly to an income tax proposition, even supposing that the Supreme Court could find adequate reason for reversing its former decision on the subject.

Standards of Luminous Intensity.

Now that we have safely come into the possession of an international candle-power, decimally connected with the hefner, it becomes of interest to observe the attitude of different countries toward this standard, and the prospects of the maintenance of this valuable international asset. The attitudes of the three countries immediately interested—England, France and the United States—are somewhat different, because England and France have each an official flame standard that, like the vestal virgins of ancient Rome, they have to keep constantly burning on the altars of their respective national laboratories, whereas America has no flame standard of her own. England has the pentane lamp in official recognition, while France has the carcel colza-oil lamp. Either of these flame standards is a comforting device for domestic photometry, so long as no comparisons are made by third parties. If no such invidious comparisons are made, one can pin great faith upon both the constancy and the reproducibility of each standard; but, as soon as these standards are compared photometrically by disinterested observers, in

order to establish a numerical ratio between their luminous intensities, troubles begin in the way of discrepancy. Reports of such comparisons at different laboratories in the photometers of skilled observers have revealed differences frequently of about 1 per cent, and occasionally of several per cent.

Such differences are not of great consequence when the photometric testing of flame lamps is undertaken, because flames vary appreciably in candle-power from hour to hour, with changes of pressure, water-vapor, temperature and carbonic acid in the air of the photometer room; but when incandescent lamps are tested photometrically, such differences become important. Incandescent filaments, operated at constant voltage below their critical brilliancy and below their temperature of rapid evaporation, hold their candle-power steadily for long periods, and can be compared to within a small fraction of 1 per cent. The advantage of a flame standard disappears with its youth. A flame standard is needed as a starting point until some more scientific device shall have been found for measuring luminous intensity than the photometer screen. But the fact that in America there is no flame standard, while nevertheless luminous intensity has been maintained and measured with great precision here for a number of years, shows that no flame needs to be maintained for photometric purposes. It is sufficient to calibrate a sufficiently large number of selected and seasoned incandescent lamps as secondary standards.

The safety of the international candle-power lies, therefore, in batches of intercompared incandescent lamps, and on the constancy of the international volt. We may expect to see the carcel flame subordinated to the secondary standard incandescent lamps in France, and the pentane flame subordinated to the correspondingly calibrated secondary incandescent lamp standards of Great Britain. The attitude of scientific Germany toward the international candle is still that of a bystander watching from afar. Germany has noted the pact between England, France and the United States in their maintaining the international candle, but has made no attempt to adopt or endorse the resolution. If, however, the maintenance of the international candle is as thorough as we anticipate, and with reference to interchanged secondary incandescent lamps we expect that eventually Germany will adopt the plan to the extent of ensuring the decimal relation of the hefner to the international candle, through incandescent lamps likewise. In that event, we should have only two units of luminous intensity in the scientific world, the hefner and the international, in the ratio of 9 to 10; while there would be but one concrete standard maintained everywhere, through the medium of incandescent-lamp interchange, expressible in either of these two units at will.

SOME ADVANCES IN PRODUCER GAS.

At the recent convention of the National Electric Light Association some extremely interesting reports were given from a form of producer intended for the utilization of cheap coals, particularly of the bituminous variety, and including even lignite. The status of the gas engine as an auxiliary in electric plants would undoubtedly be improved by the possibility of using such coals successfully, inasmuch as at the present time the great problem in economics in the power station is not so much the efficient utilization of high-grade, as a successful working of relatively low-grade fuel which can be obtained for a comparatively very moderate price. The last few years have not seen the increase in the use of gas engines that was to have been anticipated, but many of those who are close in touch with central-station practice have faith that the gas engine will prove itself a most valuable auxiliary. In Mr. Torchio's paper, to which reference has been made in our columns, the author seems to be strongly of the opinion that the gas engine is to see in the next few years greatly increased use in spite of the fact that the last two or three years have been relatively unproductive; and especially in those cases in which the same company produces both gas and electricity it is the gas engine with producer gas to which one must particularly look for valuable results. The tests reported by the committee are particularly significant in that they deal with the utilization of decidedly poor coal, some of it even being peat of as low thermal value as 6400 pound-Fahrenheit per pound. The tests were made on a 175-hp engine under brake load, receiving all its gas from the producer without the use of a gas holder. The results of the tests reported by the committee are altogether striking, particularly so with the poorer fuel. For instance, 24-hour runs were taken with two coals as widely different as Pittsburgh bituminous of over 13,000 pound-Fahrenheit units and a Colorado lignite down to 9500 units. The former showed 1.12 lb. of coal per brake hp-hour, the latter 1.61. The combined efficiency of producer and engine was 17 per cent in the first and 16.6 per cent in the second, showing that even so poor a fuel as lignite could be successfully utilized without any material reduction in efficiency. The gas produced in these tests ran about 115 thermal units, which is all that is desired for the high compression employed in the engine.

Such results as these show clearly that in point of efficiency and economical use of fuel, the producer gas plant is remarkably effective. Great things, too, are claimed for it in the way of low cost of maintenance and general reliability of operation. The use of large gas engines has sometimes been unsatisfactory from the point of reliability, and the cost of plant, including producer, has generally been such as to result in a somewhat high maintenance charge. If these recent improvements overcome the difficulties in question, one may reasonably hope for a very extensive use of producer gas in power production. From the standpoint of the central-station man it would be desirable through giving him the ability to handle part of the load at least at an exceptionally low cost of power production. The great difficulty in central-station operation is inability to store large amounts of energy in any convenient form against the hour of high demand. Improvement in storage-battery service has done much, but it is not the only resource in the matter of storage, and it may be that cheap producer gas stored at comparatively small cost may prove useful in enabling one to throw into service a considerable gas-engine capacity instead of forcing the output of other prime movers for short periods per day. The economy of combined stations other than those using merely steam and water-power has not been properly worked out as yet. We are strongly of the opinion that combined gas and steam plants are likely to play a very important rôle in the future development of electric service, and particularly when it may be possible for the same company to supply on a large scale electric-power and light and fuel gas. We shall not get the smokeless city of our dreams until such combinations are carried out.

Twentieth Annual Meeting of the Massachusetts Electric Lighting Association.

The twentieth annual meeting of the Massachusetts Electric Lighting Association was held at the Tedesco Club, Swampscott, Mass., on Thursday, July 29, about 60 members and guests being present. At a business meeting held in the forenoon the following officers were re-elected for the ensuing year: President, C. L. Edgar, Boston; vice-presidents, A. B. R. Sprague, Worcester, and C. F. Pritchard, Lynn; secretary, Everett W. Burdett, Boston.

The executive committee reported that the year had passed without the establishment of any legislation hostile to Massachusetts central stations. The outlook for municipal ownership is constantly growing less attractive, and several undesirable bills of this character were defeated during the past session. The bill sought by the town of Wakefield to permit cities and towns which have acquired plants for the manufacture of gas and electricity to purchase energy from central stations marks a forward step, the experience at Wakefield with municipal ownership being admittedly a failure. The passage of the bill increasing the powers of the Gas and Electric Light Commission so that it now passes upon the price at which new securities are issued represents constructive legislation, since by the terms of this law the directors of gas and electric lighting companies are enabled to fix the price of such securities. The board can veto the action of the directors if they overstep their authority or use improper judgment. Another important measure passed was that permitting electric companies to purchase the electrical business of gas companies under the supervision of the commission. No legislation seriously detrimental to the central station has been passed in Massachusetts for about 20 years. The special committee on uniform contract forms for street lighting reported in favor of standardization along the lines practised by the Hudson Electric Illuminating Company, of Boston, which has adopted a single-sheet standard for use in the 33 cities and towns which lie within its territory. Modifications are readily embodied in the contract when local conditions require them.

After the usual dinner and on account of the anniversary Secretary Burdett, general counsel of the association, presented a most interesting and exhaustive review of the history of the association and its relation to the development of the central-station industry in Massachusetts during the past 20 years. The association was organized in Boston in 1889, with 47 persons, representing 42 companies, present at the initial meeting. The organization was formed for the purpose of withstanding and repulsing serious attacks upon the industry which were then being planned. From 1891 to 1893, inclusive, a large part of the work of the association was devoted to the question of municipal ownership, and it was felt that had the association accomplished nothing but the defeat of the municipal ownership bill of 1890 it would have done a great work for the lighting interests of the State. The general bill which was finally passed in line with the recommendations of the association recognized the popular idea of municipal ownership, but at the same time it was just to invested capital and did not subject it to either effectual confiscation or unfair competition as did the bill of 1890. Mr. Burdett reviewed the case of the Attorney-General vs. Walworth Light & Power Company in 1892, citing the opinion of the Supreme Court of Massachusetts in favor of regarding the business of transmittting electricity through the streets of a city as a regulated monopoly and denominating as impracticable a free competition between as many companies and persons as may be minded to put up wires in the streets and try their luck.

The author discussed the amendments of 1893 to the municipal ownership law, the so-called Whitney Gas Bills of 1896, and the formation of the Massachusetts Gas Companies, with a reference to the part the association played in these events. He also touched upon the recognition as far back as 1900 of the importance of publicity in connection with the shaping of public sentiment in relation to large utility corporations. A large amount of concurrent and co-operative work has since been done, and it has apparently been attended with considerable success, as exemplified in the marked change in the attitude of the general public toward municipal ownership. Continuing, the author reviewed the changes which time has wrought in the personnel of the association and referred in high terms to the members who have passed away since it was organized.

The work done at certain specially important meetings, legislative sessions and elsewhere was outlined, including the discussion of "Municipal Lighting in Great Britain," by the general counsel in 1905; "Electrical Charges and Discounts," by Mr. Arthur S. Knight, of Boston, in 1906, and the proceedings before the Gas and Electric Light Commission instituted by the Public Franchise League against the Edison Company of Boston, in 1907. Reference was also made to the general interest of the association in the Knoxville water case and Consolidated gas case of 1908, as decided by the United States Supreme Court. Considerable space was also given to the work of the association in relation to the prevention of legislation requiring the promiscuous burying of underground wires from 1889 to date. A notable feature is that the underground-wire act in Boston has operated to the entire satisfaction of all parties concerned, as evidenced by the fact that the board of appeal from the decisions of the wire commissioner therein provided for has never had a single occasion to exercise its power; whereas, if the original bill of 1893 had been put through without the amendments which were suggested by the city and the companies interested, it would have proved to be a constant source of irritation and perhaps litigation. Since 1894 special underground-wire bills have been passed relating to the cities of Worcester, Springfield, Lowell, Haverhill, Brockton and Somerville and the policy seems firmly established of treating each case upon its merits, putting the law in such shape as will prove reasonably satisfactory to both the public and the private interests concerned.

The 29 companies which composed the original membership of the association had a combined capital of less than $5,000,000, whereas the capital of the 24 companies which at present compose the membership is nearly $26,000,000. In 1890 little if any of the stock was at more and much of it at less than par, whereas a large portion of the present capital sells at premiums as high as 100 or 200 per cent. Adding the market premium on the capital of the Boston Edison Company alone to the nominal capital of the present companies, the total investment is carried up to about $45,000,000; and if the premiums on the shares of the other companies were added the total would reach about $60,000,000, or an increase of at least 1000 per cent in 20 years.

No electric lighting business was done in Massachusetts prior to 1881. The Gas and Electric Light Commission was established in 1885. To-day the capital of the Edison Company of Boston represents a market value of nearly $30,000,000, compared with $1,500,000 for the Boston central stations of 1889. The Edison Company's wire length has increased from 3,000,000 to 17,000,000 ft. in 20 years. The lines represent an investment of over $8,000,000 to-day. Twenty years ago the Boston companies burned annually only 21,000 tons of coal, against 102,717 tons last year. Other companies follow the same rates of expansion, Worcester, for example, having gained in wire length in 20 years from 332,000 to 6,000,000 ft., with nearly 50 per cent of the present length underground. This company's annual coal consumption has risen from less than 3000 tons to about 8000 tons, and its boiler equipment from 650 to 3000 hp.

In spite of enormous increases in central-station investment, the quality of the service has been steadily improved and the price decreased. A better and more liberal treatment of the public is coincident with larger earnings and increased dividends. The total dividends paid in 1889 were about $172,000 the rate being 6 1/3 per cent, while in 1908 the dividends were over $2,000,000, at an average rate of 9.65 per cent. Twenty years ago the amounts paid by the companies in taxes did not appear in the reports of the Gas and Electric Light Commission. In 1909 the central stations in the State paid in taxes more

than $700,000, of which the Boston Edison Company alone paid nearly $400,000, or at the rate of 50 cents for every man, woman and child in the area supplied with energy by it. This company alone paid in 1909 2.5 times as much in taxes as was paid in dividends by all the companies of the State in 1889. It thus appears that a large part of the money which the consumer pays for electricity goes back into the public treasury in the form of taxes.

Mr. Burdett then cited the figures below compiled by Mr. T. Commerford Martin, editor of the *Electrical World*, for the United States Census of 1905, showing the increase in the general electrical manufacturing industry of the country between 1890 and 1905.

	1890.	1905.	Increase, per cent.
Capital employed	$18,997,337	$174,066,026	815
Persons employed	9,485	71,085	646
Salaries and wages	$5,366,188	$42,932,406	700
Cost of materials used	$8,819,498	$66,836,926	658
Miscellaneous expenses	$1,154,462	$17,948,708	1,470
Total expenditures	$15,340,148	$127,718,040	753
Value of products	$19,114,714	$159,551,402	740

Regarding municipal ownership, Mr. Burdett said that only 26 out of the 354 municipalities of the State, and including only 3 cities, have established plants of their own, and of these 7, or more than 25 per cent, have distribution plants only and buy energy from private companies. The total investment in municipal plants is only about $4,000,000, or an average of about $156,000 each, while the average of 80 private companies in the State is $375,000. These contrasts seem to illustrate the differences in results to be expected from the encouragement of private as against public enterprise. In Massachusetts there was not in 1908 one town out of the 92 municipalities of over 5000 people without an electrical supply.

The speaker closed with an outline of the developments to be expected in the future, sketching with a bold hand the possible sources of energy, the centralization of plant and concentration of commission control to be anticipated.

President Edgar then called upon Prof. Elihu Thomson, who was the guest of honor at the dinner. Professor Thomson emphasized the importance of cheap energy in the advance of civilization, touched upon the value of the tungsten lamp in decreasing the required generating plant equipment and urged the significance of the distribution problem in the central-station field. It ought to be possible with the tungsten lamp and a single-tube distribution system to secure as a customer every man upon the street. With one wire in an outside grounded copper tube a great deal can be accomplished, at, say, 2300 volts. This main can be extended into houses more easily than a gas pipe; it is absolutely safe and the installation of fittings is an exceedingly simple matter. Such a tube does not deface anything and can be made extremely flexible by screw couplings. Professor Thomson concluded by a short discussion of the importance of conserving the fuel supply, the costliness of battleship fuel consumption even in times of peace, and the probable influence of the recent progress in aviation upon battleship construction and the elimination of war.

Forecasting Public-Service Development.

Under the unusual title "Public Utility Fortune Telling," Mr. Harold Almert, manager of the department of examinations and reports of H. M. Byllesby & Company, of Chicago, addressed the members of the Electric Club of Chicago on July 28. Mr. Almert's talk related to the probable future development of public-service companies, with which his own work is immediately engaged, and he said that despite the "hot-weather" title that he had given it, the subject has a serious side. The electrical utilities of this country have assumed such large proportions that it is a problem of great magnitude to plan and supervise the financial end of the business. In ordinary commercial pursuits statistics show that 97 per cent of all mercantile businesses fail within five years of their establishment. It is therefore necessary, when a public utility, either new or old, is to be financed, to examine carefully into its condition and prospects. The foretelling of the future success of these utilities has been reduced almost to an exact science.

Often small central-station plants are organized by local business men who are not familiar with the business. To this lack of management is often to be added the further fact that small companies are very frequently under-capitalized. In many small plants too much of the earnings have to go into extensions. In the case of large plants failures are sometimes caused by a directly opposite characteristic, that is over-capitalization.

The present-day tendency is toward the combination of smaller stations into a large proposition. In many cases combinations of this sort are advantageous and profitable. Large properties can float bond issues more easily than small ones. On small issues the percentage for brokerage is often excessive and the rate of interest is high. These objections are done away with by issues on a combination of small properties.

In examining properties an engineer is first retained to make an examination and report before the financial house will consider the proposition seriously. Many engineers seem to be pessimistic. One reason is that in a proposition involving a considerable expenditure of money they prefer to err, if at all, on the conservative side. Another reason is that the easy way to handle a proposal of this character is simply to "turn it down" and say there is nothing in it. Nevertheless, Mr. Almert gave it as his opinion that the majority of steam central-station propositions "put up" to financiers have merit. Many things are to be considered, such as the population served, the character of the population, the general business condition of the town or towns, bank deposits and the like. A curve of probable extension of the business that may be expected is plotted as one of the early preparations in the making of the examinations and reports of this charter.

Touching briefly on the municipal-ownership agitation of three years ago and its results, the speaker said that, as they are conducted at present, the existence of State public-service commissions is certainly a great benefit to the industry. This method of control is superior to the uncertainties of local control. But there is an element of danger in these commissions owing to the possibility that some time in the future they may pass under the sway of politicians. The management of central-station properties has changed with the development of the art. Formerly it was thought that a man should have legal training to be a manager, and that he might hire technical brains to assist him. Later it was considered that engineers were best qualified for this work, but at present the approved idea seems to be to employ technical men trained also in practical business affairs. Men of this stamp appear to get the best results.

The discussion was opened by Mr. H. E. Niesz, manager of the Cosmopolitan Electric Company, Chicago, who pointed out that it was necessary in the early days to pay a great deal of attention to technical subjects, because the changes in the art were so frequent and of such a revolutionary nature. It was therefore advisable that technical men should be in charge of the companies giving electrical service. Later this side of the business became standardized to a considerable extent, although improvements are still constantly going on. It then became necessary to develop the commercial end of the business; it was of vital importance to enlarge the market. The change in the character of the management of central-station companies has simply kept pace with the development of the art.

Mr. E. A. Bullock, of Norfolk, Neb., former president of the Nebraska Electrical Association, was present as a guest, and he was called on to speak. He corroborated Mr. Almert's statement that the ordinary small plant is under-capitalized, and gave some facts that had fallen under his own observation to prove this statement. Central-station men have found that it will not do simply to build a plant and wait for customers to come in; it is necessary for the men in charge to go out and get the business. Mr. Bullock concluded his brief remarks by saying that the small Western town is worth more per inhabitant to the public-utility corporation than Eastern or Southern towns of equal or even considerably larger size.

Patent Agreement Between Germany and the United States.

According to a reciprocal patent treaty, for which ratifications were exchanged by Secretary of State Knox and the German Ambassador, Count Bernstoff, in Washington, on July 14, American inventors will greatly benefit from the removal of the German restriction under which their patents have hitherto been forfeited if not actually worked in Germany within three years. Under the new treaty an invention reduced to practice in either country is fully protected in both countries when patented in both Germany and the United States. The United States Government, through the State Department, has been taking prompt measures to relieve inventors and the manufacturing and export industries from unjust discriminations in the laws of foreign countries, and last year sent Edward B. Moore, Commissioner of Patents, as a delegate to the International Congress for the Protection of Industrial Property, which met in Stockholm. From Stockholm Mr. Moore proceeded to Berlin, and succeeded in negotiating a tentative reciprocal agreement with the German Government which has resulted in the treaty just established. The agreement is immediately effective, and is to remain in force until the expiration of 12 months following a notice of termination by either Germany or the United States.

It is said that at the next official Congress for the Protection of Industrial Property, which will meet in Washington in 1910, about 30 nations will be represented. An endeavor will be made to harmonize the laws of the various nations relating to the protection of patents and trade-marks.

New York Public Service Commission News.

The Public Service Commission of the First District of New York has appointed Edward G. Connette transportation engineer, a position which pays a salary of $8,000 per year. This office, the head of the transportation department, has never been filled heretofore, although it was provided for in the original plan of organization of the commission. Under this department are the bureau of equipment inspection, until recently headed by A. W. McLimont; the bureau of transit inspection, headed by Daniel L. Turner, and the bureau of accidents and complaints, headed by George F. Daggett.

The Interborough Rapid Transit Company has informed the Public Service Commission that on Aug. 15 it will have ready for service 42 steel cars fitted with side doors for express trains and that by Oct. 15 enough cars will be ready to maintain a 1.5-minute express service in the subway.

The Dock Department of the city of New York has asked the Public Service Commission to order the removal of the loop, used by the Broadway and Sixth Avenue surface lines, at South Ferry. It is alleged that there is no franchise for this loop and that it seriously interferes with trucks boarding and leaving the ferries. The commission will look into the matter of franchise before taking any action.

The Public Service Commission of the Second District has authorized the Nassau & Suffolk Lighting Company to issue its preferred 6 per cent capital stock to the aggregate amount of $420,000, the proceeds to be used for the extension and improvement of its plant and distributing system, for additional working capital to the amount of $25,000, and for the payment of various obligations amounting to $87,500. The company is operating in a rapidly growing territory and it is its intention to increase its facilities.

The commission has authorized the Delaware & Eastern Railway Company to issue its capital stock, par value, of $2,050,000, and its 50-year 5 per cent gold bonds secured by its mortgage dated July 1, 1907, to the Empire Trust Company of New York City, to the amount of $4,570,000 par value. The company is granted permission to sell the bonds at not less than 80 and accrued interest, except that $3,500,000 may be sold at par in accordance with the terms of an underwriting agreement filed with the commission. The capital to be secured by the bonds is to be used for the construction of its proposed road between Schenectady and a point near Hancock, Delaware County, dividing the States of New York and Pennsylvania.

The commission has authorized the Rockland Light & Power Company to issue $100,900 5 per cent bonds, under its mortgage, dated Dec. 7, 1908. The bonds are to be sold at not less than 90, and the proceeds of 50 of the bonds are to be used to discharge the bonds of the Nyack Gaslight & Fuel Company, now merged with the Rockland Light & Power Company, and the remainder for the extension and improvement of the plant and distributing system of the applicant company.

Spectacular Electric Illumination During the Hudson-Fulton Celebration.

For eight nights during the Hudson-Fulton celebration, Sept. 25 to Oct. 9, New York in all its boroughs will be the most brilliantly illuminated city in the world. The illumination will begin each night at 6:30 and continue until 12:30 a. m. Estimates place the number of lamps to be used, in addition to the regular lighting of the city, at between 1,000,000 and 1,500,000 incandescents, 7000 arc lights, 3000 flaming arcs, one battery of 4 searchlights of 100,000 cp each and one battery of 12 searchlights aggregating 1,700,000 cp. This estimate may be greatly increased by electric advertising signs, for which contracts have already been made by electric lighting and display advertising firms. In this estimate no account of the lamps along the New Jersey shore and in other places adjacent to but outside the city limits is taken.

This remarkable illumination is a part of the plan of the Illumination Committee of the Hudson-Fulton Celebration Commission, of which Mr. William Berri is chairman. In addition to the city illumination Mr. Berri's committee has charge of the lighting of the Hudson River Valley on the last night of the celebration, Saturday, Oct. 9, from New York to Troy, a distance of 170 miles, with huge signal fires on mountain tops.

One of the most remarkable features of the illumination in New York will be the probable use of the immense battery of searchlights to be located on Riverside Drive at 110th Street. This searchlight battery will be first put in operation on the night of Saturday, Sept. 25, and continue until the end of the celebration. When brought together in a single beam, as it will be on the night of Oct. 9, it will be visible for 50 miles.

The Hudson-Fulton Celebration Commission will pay the expense of this battery of searchlights and a small battery of four searchlights which will play upon Grant's Tomb and for approximately 170,000 incandescent lamps, while the balance of the display will be made by private citizens, theaters, banks, corporations, office buildings and advertising firms.

The Queensborough Bridge, Brooklyn Bridge, Williamsburgh Bridge and Manhattan Bridge crossing the East River will be outlined from end to end by electric lamps. In Manhattan, the City Hall will be elaborately illuminated, as will be the Memorial Monument at Fourth Street and Fifth Avenue and the entire routes selected for the parades from Fourth Street up to Fifty-ninth Street through to Eighth Avenue to 110th Street will be lined throughout with festoons of electric lamps on the curb line. It was first intended to festoon across the entire streets, but the height of the floats for the historical and carnival parades has made this impossible. These festoons at all the reviewing stands will be made up of floral garlands interspersed with electric lights and producing a very beautiful artistic effect. This entirely original feature was designed by Mr. Charles R. Lamb, chairman of the Committee on Decorations. The Viaduct Bridge on Riverside Drive will be outlined throughout, also the Soldiers and Sailors' Monument at Ninety-second Street and Riverside Drive.

In Richmond the new Borough Hall and in Queensborough the Borough Hall building will be strikingly illuminated. In Brooklyn the Borough Hall, the Soldiers and Sailors' Monument, at Prospect Park, the water tower and the Museum of Arts and Sciences will be electrically outlined. In The Bronx

the Borough Hall will be studded with electric lamps. The building is on a high elevation and will make a fine showing. The Martyrs' Monument at Fort Greene, Brooklyn, will, it is hoped, for the first time have the intention of the late Stanford White, the architect of the monument, carried out by the building of a continuous fire in the enormous urn on the tripod at the top of the shaft. Contracts have been made with the following electric light companies:

The New York Edison, the Edison Electric Illuminating Company of Brooklyn, the United Electric Light & Power Company, the New York & Queens Electric Light & Power Company, and the Richmond Light & Railroad Company.

A large number of contracts have been made for electrical illumination on both sides of the Hudson up to and opposite Spuyten Duyvil. The steamship companies are all becoming active in the matter, as are also most of the other occupants of river-front property.

On the evening of Saturday, Sept. 25, with 30 or 40 foreign and American warships anchored off 110th Street, a grand fireworks display will be given on floats on the New Jersey side of the river in honor of the visiting vessels.

In Manhattan upon the line of parade the great clubs and hotels are arranging for their illumination. The Union League Club will have a most beautiful showing. It will deservedly attract great admiration for its artistic beauty and elaboration.

The line of carnival parade on the night of Saturday, Oct. 2, will be a gorgeous lane. Thousands of dollars' worth of colored fire will also be used during the procession to light the floats.

The illumination committee has practically determined the location for the signal fires up the Hudson River that are to be placed between New York City and Newburgh in connection with the scheme for illuminating the entire river front on Saturday night, Oct. 9, which will be known as illumination night.

Subject to change, the other points selected are as follows: Governor's Island, Fort Lee, Fort Washington, Spuyten Duyvil, Alpina, Hastings' Point, Staten Island, Hook Mountain, High Tor, Stony Point, Dunderburgh, Anthony's Nose, Sugar Loaf Hill, West Point, Constitution Island, Storm King, Bull Hill and Crow's-Nest.

Up the river every town is arranging for displays. This is particularly true of Newburgh, where the plans tentatively adopted give assurance of a magnificent illumination both of the buildings on the river and the mountain peak signal fires.

Probable Short-Time Gas-Lighting Contract in Boston.

On account of a provision recently discovered in the new charter of the city of Boston, which was passed by the Legislature of 1909, it is probable that the municipal authorities will make only a short-time contract for the illumination of thoroughfares of secondary importance by gas lamps. Since the signing of the main street lighting contract last May with the Edison Electric Illuminating Company of Boston, the Street Department has been considering the question of renewing the contract whereby many of the minor streets are lighted by gas, some 12,000 lamps being operated in this service at present by the Rising Sun Street Lighting Company. Bids were asked for and passed upon July 1, and the contract would have been awarded to the so-called Greater Boston Illuminating Company had that organization been able to furnish the necessary bond of $50,000 within the specified time. On July 11, section 16 of the new city charter went into effect, and its wording is such as to forbid the city from making a contract for a later date than the first Monday of February, 1910, when another section of the charter (No. 6) goes into effect providing that a lighting contract extending over a year shall not be valid without the approval of the Mayor and the City Council after a public hearing suitably advertised in the *City Record*. The Finance Commission called the attention of Mayor Hibbard to this situation, with a confirming opinion by Corporation Counsel Thomas M. Babson. As a result the city will have to make the best terms possible for the continuation of the lighting from Sept. 15, when the present Rising Sun contract expires, until the close of the municipal year in February next.

The city will probably have to follow one of the subsequently named courses; the Rising Sun Company may be willing to continue its present system at a fair rate; the lighting may be done in part by municipal employees or sublet; or the Edison Electric Illuminating Company may extend its system by furnishing possibly 5000 60-cp incandescents at the contract rate of $22.31 per lamp per year, leaving the balance of the 12,000 lamps to be supplied by some gas-lighting organization. Under present conditions it is doubtful if the Edison Company would feel itself justified in making the enormous investment necessary to reach the locations of all the present gas lamps on minor thoroughfares, and its contract of May 5 last sets a limit of 400 ft. on extensions to its overhead system and 100 ft. on underground extensions at the request of the municipality for additional lamps. The Edison Company's price is less than that of the Rising Sun Street Lighting Company by about $1.29 per lamp per year, but the feeder investment required to displace the present gas lamps would probably be over $1,000,000. There is a growing sentiment, however, in favor of the tungsten lamp for minor lighting, and it is possible that within a few years developments may occur which will drive the gas lamp from its present position in the subordinate streets of Boston. The Edison Company already operates over 1000 tungsten lamps in this class of service.

Association of Special Libraries.

The Special Libraries Association has been organized for rendering mutual assistance among the special libraries so as to diffuse accurate information as to the authorities on a wide range of subjects, prevent the unnecessary duplication of purchases, and enable the most useful books to be obtained without buying a large number treating the same subject. The following officers have been elected:

President, John Cotton Dana, librarian, Free Public Library, Newark, N. J.; vice-president, Robert H. Whitten, librarian, Public Service Commission, First District, New York; secretary-treasurer, Anna Sears, librarian, The Merchants' Association of New York; executive committee, Herbert O. Brigham, librarian, State Library, Providence, R. I., and George W. Lee, librarian, Stone & Webster, Boston, Mass.

Although only about one month old, the association has a membership of about 50 special libraries. An important feature of its work will be the preparation and publication of bibliographies. Certain special libraries are authorities on finance and taxation, insurance, public utilities, real estate, etc., as they make a point of gathering everything published on the specific subject in which they are especially interested. The librarians in charge of these collections, who qualify as experts on the literature in question, will compile special bibliographies on public utilities, finance and taxation, etc. These bibliographies will be annotated, thereby affording all the necessary information as to the works in the list, and will be circulated among all the members of the Special Libraries Association.

Massachusetts Public Utility Legislation.

In the recently adjourned session of the Massachusetts Legislature of 1909 about 2100 bills were introduced, nearly one-third of which became law. The session was characterized on the whole by a reasonable attitude toward public utility corporations, with a disposition to see fair play in the central station, gas, electric railway and telephone fields. Several measures of more than local interest were taken up, and many proposed laws distinctly hurtful to the companies or destructive of the spirit of conservative regulation by commissions were defeated.

One of the more important measures which became law was a bill relative to the purchase, sale and consolidation of gas and electric light companies (Ch. 316, Acts of 1909). The new law provides that a gas company may, under the approval of the Gas and Electric Light Commission, sell its locations and the

property used in its business of generating and furnishing electricity for light and power to an electric light company whose lines are in the same or a contiguous municipality. In the passage of this act the tendency toward centralizing the generation and distribution of electricity was recognized, and the way opened for gas companies who find themselves more or less burdened with an auxiliary electrical supply business to turn this department of their work over to the central-station interests. The most important application of this law thus far is the pending consolidation of the electrical departments of several suburban gas and electric properties with the Edison Electric Illuminating Company of Boston, which is now before the Gas and Electric Light Commission for approval.

An appropriation of $5,000 was made for the determination of the amount of water-power available on the streams of the State, and for investigating the best methods of utilizing it to further industrial improvement. The Governor is authorized by the act to contract with the director of the United States Geological Survey for this work. A brief report of the work, which it is hoped will be furthered by a like Congressional appropriation, is to be made on Jan. 1, 1910, and a complete and final report a year later (Ch. 359, Acts of 1909).

One of the measures which attracted widespread attention in Massachusetts was the so-called "telegram time-filing law," which became legislation without Governor Draper's signature on April 17. The law provides that every telegraph company shall cause to appear plainly upon the addressee's copy of every intra-State message the hour and minute of the day on which it was filed for transmission and the hour and minute of the day of its receipt at its destination. As soon as the law went into effect the companies instituted a charge for the transmission of this information and within a few days an amendment was passed forbidding the imposition of such charges. (Ch. 402, Acts 1909.)

A law was passed requiring every gaslight company with a capital paid in of $100,000 or more, and others, if required by the Board of Gas and Electric Light Commissioners, and all makers and vendors of meters to set up at some convenient place upon their premises one or more meter provers of a size and type approved by the board, and tested and calibrated by the board. A meter cannot be stamped correct if it varied more than 2 per cent from the standard measures. The board is required to keep a correct record of all meters examined by its inspectors with their proof at the time of inspection, and this record is open at all times for examination by the officers of any gaslight company in the State. Every gaslight company manufacturing or selling more than 15,000,000 cu. ft. of gas per year may be required by the above board to maintain a testing room with an approved disk photometer and equipment at least one-fourth mile from the gas works, open to the inspection division of the board from 8 a. m. to 6 p. m. Illuminating gas of every company of over 50 customers is to be tested at least twice a year, and the board is allowed, within certain specified limits, to establish a standard for the purity of the gas from time to time. A fine is imposed for continued impurities or inferior illuminating power. Provision is also made in the law for the appointment of inspectors and the testing of consumers' meters for fees (Ch. 483, Acts of 1909).

One of the most important laws passed during the session provides that a gas or electric light company shall upon increasing its capital stock (above 4 per cent of the existing capital stock) offer the new shares proportionately to its stockholders at such price, not less than the par value, as shall be determined by its board of directors. The vote of the Gas and Electric Light Commission as to the amount of stock which is reasonably necessary for the purpose for which the increase has been authorized is based on the price as fixed above unless the commission is of the opinion that the price is so low as to be inconsistent with the public interest, in which case the commission may determine the price at which such shares may be issued. If the increase in stock is less than 4 per cent of the existing stock of the company, the directors, without first offering it to the stockholders, may sell the shares by auction or by tender to the highest bidder at not less than the par value. They are also required to sell at public auction any shares remaining unsubscribed by the stockholders authorized to take them, under the supervision of the commission. No shares can be sold for less than the par value paid in cash. This law relaxes somewhat the severity of the Massachusetts statutes bearing upon central-station stock isssues, while safeguarding the public interest as well. It places the gas and electric light companies upon a footing similar to that held by railroads and street railways before the Railroad Commission. (Ch. 477, Acts of 1909.)

A law was passed authorizing municipalities to permit the construction and maintenance of pipes and conduits under the public highways for the transmission of steam or hot water for heating, cooking or mechanical power. (Ch. 103, Acts of 1909.) Another bill was passed which provided that a city or town which has acquired a plant for the manufacture or distribution of gas or electricity may purchase gas or electricity from any other municipality or corporation manufacturing gas or electricity. (Ch. 173, Acts of 1909.) By Chapter 313 of this year theaters are required to install an emergency arc light or its equivalent in the auditorium, and this light, together with exit, corridor and other auxiliary illumination, is required to be fed independently of the stage lighting and controlled from the lobby or front of the house. In specific legislation, the Beverly Gas & Electric Company was authorized to do business in the town of Topsfield (Ch. 438, Acts 1909); the Metropolitan Water and Sewer Board was authorized to sell or lease certain lands for electric power transmission (Ch. 473, Acts 1909); the town of Framingham was authorized to procure electricity for use in pumping sewerage and water (Ch. 479, Acts 1909); there was established an electric light district in the town of Erving (Ch. 496, Acts 1909); the Holyoke Water Power Company was authorized to sell energy to certain mills in Holyoke and to certain existing or prospective municipal plants (Ch. 152, Acts 1909); and Ch. 72, 1909, provides that only one mile of streets shall be the annual requirement for a change from overhead to underground construction in the city of Springfield in 1909.

In the street-railway field perhaps the most important general measure passed was an act to allow companies to issue stock or bonds to supply working capital, under supervision of the Railroad Commission. In connection with the determination of the taxable value of corporate franchises as provided for in existing statutes, an amendment was passed to the effect that "underground conduits, wires and pipes laid in the public streets, and poles, underground conduits and pipes, together with the wires . . . for the purposes of taxation shall, like rails and rights of way, be included in, and not deducted from, the value of the corporate franchises." The burdens of taxation are somewhat relaxed by the inclusion of the poles in the valuation. Special legislation authorizing the New York, New Haven & Hartford Railroad Company to develop the Berkshire Hills district through the purchase of the Berkshire Street Railway system was postponed until next year.

Among the measures which failed to become law this year were bills to reduce the price of gas in Charlestown, East Boston, Fall River and Chelsea; a bill to permit municipalities to establish or acquire lighting plants on a majority vote of each branch of the city council passed in any municipal year and thereafter ratified by a majority of votes at any special or annual city election; a bill to permit gas companies to adopt the tri-partnership system of prices, dividends and wages; a bill to make the price of electricity uniform in rate for all customers without regard to the amount of energy consumed; a bill to require electric companies to instruct their customers in the reading of meters, and a similar measure for gas companies; and bills to prohibit gas companies and central stations from making a meter rental or readiness-to-serve meter charge.

One of the most dramatic incidents of the year was a rebuke by Speaker Walker, of the House, uttered in connection with the bill to reduce the price of gas in East Boston. The bill had almost reached the Governor when the Speaker succeeded in recalling and killing it by a vigorous speech emphasizing the importance of maintaining the State's long-established and successful policy of referring technical questions of this character to its expert commissions.

Latest Aspects of the Tariff Situation.

The new tariff bill, which passed the House of Representatives last week, is the tariff bill which will in all probability be the new law. It is expected to pass the Senate before the end of the present week and it is assured that the President will sign it at once. The vote in the House was very much closer than had been anticipated, and it is generally believed in Washington that if the Democrats and objecting Republicans had been better organized they would have been able at least to have recommitted the bill, if not to have defeated it. At the time that this is written, it is believed that the vote in the Senate will be very close, although there is little fear of failure expressed by the Republican organization.

As far as the electrical trades are concerned, there is not much change in rates from the present scehdules. The only serious contest for lower rates of duty that was made came from the importers of lighting carbons, and these not only failed to secure a reduction, but, it is claimed, will have to pay considerably higher duties.

CARBONS.

Section 96 of the new law which deals with the carbon schedule reads: "Carbons for electric lighting, wholly or partly finished, made entirely from petroleum coke, 35 cents per 100 ft.; if composed chiefly of lampblack or retort carbon, 65 cents per 100 ft." Under the Dingley law the rate for all carbons was 90 cents per 100 carbons. The apparent reduction from 90 cents to 65 cents is not, however, a reduction, but is an actual increase, according to the statements of the importers. This is brought about by the insertion of the word "feet." The only lighting carbons which have been imported under the present law or which will be imported under the new law, are the high grade goods, such as are used in searchlights, moving-picture machines, flaming-arc and enclosed-arc lamps. More than 90 per cent of all the importations are carbons for enclosed arcs. Under the present law—90 cents per 100 carbons—the importers have been bringing in their goods in 24-in. and 28½-in. lengths and cutting them here. By this means the duty instead of being 90 cents, was less than 45 cents per 100 on carbons of 12-in. length, which is the ordinary length for enclosed arcs. It is easy to see how the introduction of the word "feet" breaks up this system of importation in double lengths and practically advances the rate more than 20 cents per 100. As 24 in. is the most common length for flaming-arc carbons, it is not hard to see that the new law increases the duty on these from 90 cents per 100 to $1.30 per 100.

The clause which fixes the rate for "petroleum coke" carbons—the ordinary cheap carbon used in the open arc—at 35 cents per 100 ft., in reality means nothing to the trade. These carbons are not imported under the present law and will not be imported under the new law. It is likely they would not be imported if they were admitted duty free, as, owing to the greater abundance in this country of the raw material from which they are made they can be produced cheaper here than abroad. These carbons now sell to the consumer at from 60 to 80 cents per 100 in 12-in. lengths, so that a duty of 35 cents per 100 ft. is practically a tax of 50 per cent ad valorem.

Carbon electrodes, brushes, plates and disks, which under the Dingley bill paid a duty of 35 per cent ad valorem, will now pay a duty of 30 per cent; and porous carbon pots for batteries, which formerly were taxed at 20 per cent, come in under the new law at the same rate.

In speaking of the fight on lighting carbons, a Washington representative of the importers who was especially interested in flaming-arc carbons, had this to say: "I do not think there was ever much opportunity to get a reduction on enclosed arc carbons, for the American manufacturers brought too much influence to bear for us to overcome it. If, however, we had been able to work out a descriptive definition that would have covered flaming-arc carbons alone, I believe we might have got a material reduction on these. A number of Senators were willing to listen to the arguments of the flaming-arc importers, and the American manufacturers were not particularly interested in the matter. Several definitions were discussed but the trouble was that none could be found to cover flaming-arc carbons alone which would not be open to a construction that would admit other carbons as well."

MICA.

The new schedule covering mica is unchanged from the provision which originally passed the House, April 9, 1909. The new rate is: For unmanufactured mica, or rough trimmed only, 5 cents per pound and 20 per cent ad valorem; for mica cut or trimmed, mica plates or built-up mica and all manufactures of mica, 10 cents per pound and 20 per cent ad valorem. Under the Dingley law, uncut mica was 6 cents per pound and 20 per cent ad valorem, and manufactured mica was 12 cents per pound and 20 per cent ad valorem. The new rates are, therefore, a small reduction in the specific duty, but will have very little effect except upon the very cheap grades.

MANUFACTURED GOODS, ETC.

In the original draft of the new law, as it passed the House, electrical machinery was specifically named and the duty on it fixed at 30 per cent ad valorem. The Senate, however, eliminated this special reference and the bill as adopted does not mention electrical apparatus or machinery and, therefore, these imports will come under the general provision covering manufactures composed wholly or in part of metal, which must pay a duty of 45 per cent ad valorem. The section covering these goods is exactly the same as that in the Dingley law and the rate is the same.

Steam engines and machine tools under the new law will pay a duty of 45 per cent ad valorem, which is the same as has been paid under the present law. An exception has been made in the new law in the case of nippers and pliers, which will pay a duty of 8 cents per pound and 40 per cent ad valorem.

Incandescent lamps will continue to be admitted at 45 per cent ad valorem under the unenumerated manufactures, in which metal is the component of chief value.

Telegraph, telephone and other wires and cables composed of metal and rubber or of metal, rubber and other materials are expressly taxed in the new law at 45 per cent ad valorem. Under the Dingley act such wire was not named, but paid the 45 per cent rate under the unenumerated clause, while cable, rubber or gutta-percha covered paid 35 per cent.

Poles, telephone, telegraph, trolley or electric light, under the new law will pay a duty of 10 per cent ad valorem. Under the present law they paid a duty of 20 per cent ad valorem.

RAW MATERIALS.

Tungsten, tantalum and wolfram metal are especially named in section 184 of the new law and will pay a duty of 25 per cent ad valorem, when valued at $200 or less per ton, and 20 per cent ad valorem when valued at more than $200 per ton. Under the Dingley law these metals all came in under the unenumerated metals at 20 per cent ad valorem.

Aluminum under the new law will be admitted at 7 cents per pound in its crude shape and in plates, bars and rods at 12 cents per pound; under the present law the rate for the crude is 8 cents and for the plates, etc., 13 cents. Articles manufactured of aluminum, under both the new and the old law, pay 45 per cent ad valorem. The reduction of 1 cent per pound in the metal schedule will have no effect, so it is claimed, upon the price at which aluminum wire is sold.

Lead in bars and pigs pays a duty under the new law of 2⅛ cents per pound, the same as under the Dingley law, while lead in sheets pays 2⅜ cents per pound as compared with 2½ cents at the present time.

Red lead and litharge are taxed under the new law at 2⅝ cents per pound. This is not only a slight reduction, but unifies the rate on the two materials. Under the Dingley law red lead paid a duty of 2⅞ cents per pound and litharge 2¼ cents.

Zinc has had a slight reduction of duty. Under the new law in blocks or pigs the tax will be 1⅜ cents per pound as against 1½ cents under the present law, while zinc in sheets will be 1⅝ cts. per lb. compared with 2 cts. under the present law.

Copper ore, scrap copper, copper in plates, bars, ingots and pigs are admitted free. Brazier's copper, sheets, rods, pipes and copper bottoms pay 2½ cents per pound. These rates are unchanged from the present law.

Massachusetts Commission News.

The Massachusetts Gas and Electric Light Commission has closed the public hearings in the petitions of the Malden & Melrose Gas and the Fitchburg Gas & Electric Light companies for new security issues, and decisions are pending. The board has granted the Beverly Gas & Electric Company permission to extend its service into Topsfield. Other pending matters which have been heard are the petition of the Association of Massachusetts Gas Companies requesting the board to determine the amount of sulphur in gas which may be permitted and setting the quantity at 30 grains per 100 cu. ft.; the petition of certain consumers of the Charlestown Gas & Electric Company for a reduction in the price of gas; the petition of consumers of the Stoughton Gas & Electric Company for a reduction in the rates for electric service; and the petition of the Edison Electric Illuminating Company of Boston for authority to purchase the electric property and business of the Boston Consolidated Gas Company, the Newton & Watertown Gas Light Company, the Lexington Gas & Electric Company, the Waltham Gas Light Company and the Chelsea Gas Light Company. Another pending case is the petition of Joseph Leonard and others to have the meter charge of the Boston Edison Company reduced. As previously noted in our columns the Worcester Electric Light Company has appealed from the franchise granted by the Board of Aldermen to the Connecticut River Transmission Company, but no hearing date has been assigned.

At a hearing recently given in connection with the petition of the Edison Company of Brockton to purchase the Bridgewater Electric Company and to issue $160,000 in stock to pay for the property of the Stoughton Gas & Electric Light Company and also certain floating indebtedness incurred in the construction of new plant, the question of purchasing a plant independently of its franchise came up. Mr. A. Stuart Pratt, of the Stone & Webster organization, the controlling interest and managers of the above properties, stated that the stockholders of the Stoughton company, having sold their physical property, but not their current assets nor cash, intend to liquidate and go out of business. He said that the Stoughton's company's franchise would then cease to become operative, because a new franchise has been secured in the town by the Brockton company. It was supposd that there was no difference between the Edison company acquiring the property of the Stoughton company and the purchase of any kind of supplies from any electric supply company. The stockholders of the Brockton Edison Company had voted unanimously to go into the gas business, and the Stoughton Board of Selectmen had granted the company a franchise to that effect. It was explained to the Selectmen that the Stoughton company would cease to do business and that the Edison would supersede it. Commissioner Schaff asked if the petitioner felt that by changing its title it could go ahead and do a gas business without the consent of the board. Mr. Pratt replied in the affirmative, and General Schaff stated that it was the first instance he recalled of such a construction on the part of an electric light company. He felt that the legal situation ought to be made clearer. Counsel George for the petitioners called attention to the unsatisfactory condition of the earlier and later acts with regard to gas and electric light companies in Massachusetts, saying that the relations between the more modern and the earlier laws are considerably mixed. Every effort had been made to comply with the law. Commissioner Weed stated that in his opinion it was rather a grave question in the light of the recent statutes whether at the present time a gas company, as such, doing an electric-light business, as this Stoughton company, can sell all of its property to an electric-light company. "Such a method," he said, "if employed by men who were not friendly to the interests they were serving, might result in considerable embarrassment." General Schaff concurred in this, but emphasized his belief in the public benefits of the purchase of weak, struggling companies by strong ones. The whole situation is centered, from the engineering point of view, upon the establishment of the new turbine station of the Brockton Edison Company at East Bridgewater and supplying service from it to many neighboring communities, shutting down the inefficient local plants. The Brockton prices are put in force in all the territory, although the public does not realize the loss in the transmission lines. The net rates in Brockton were reduced to 15 cents maximum on July 1. Mr. Pratt stated that to counteract the loss of earnings a soliciting force is hard at work and is meeting much success in increasing business in both the lighting and motor fields. The company has moved to a fine office building in the center of the city and is exhibiting the latest appliances.

Boston Edison Lecture Course for 1909-10.

The Employees' Club of the Boston Edison Company has arranged, through its lecture committee, for a course of lectures this coming winter in continuation of the course carried through last winter. "Steam" and "Alternating Currents" will be the general subjects taken up, 8 lectures to be devoted to the first and 12 to the latter topic, making 20 in all. The lectures will be duplicated in the afternoon and evening of one day each week beginning on Nov. 4. The double lectures will make it possible for employees who work on different shifts to attend. Prof. Sydney W. Ashe, who gave the course last winter, has been engaged to conduct the coming one. He will take up to a considerable extent the points of advanced theory of operating methods.

The attendance for the course last season averaged 26 men at the afternoon lectures and 164 men for the evening lectures, making a total attendance for the 20 double lectures of 3808. These courses are conducted under the management of the Employees' Club lecture committee, made up of Messrs. H. W. Moses, chairman; W. E. Cooke, Pierce Kent, D. P. Miner and F. D. Stiles. While the success of last winter's course and the prospective success of the coming lectures should be credited in a general way to the interest of the Boston Edison employees, between 80 and 90 per cent of whom are members of the club, much credit should be given the officers of the Boston Edison Company, who have taken an active interest in the welfare of the club at all times. Several plans for broadening the scope of the club's activity and for the increasing development of studious habits, as well as strengthening the social features, are under consideration.

Property of the Pacific Gas & Electric Company.

It is estimated that the physical valuation of the property of the Pacific Gas & Electric Company is $90,000,000. The electric properties comprise 154,000 developed electrical hp. Of this amount 94,000 hp is generated by water at 11 hydro-electric stations, and 60,000 hp is generated by steam and gas at six stations. The company also owns undeveloped water-power exceeding 100,000 hp, and 31 reservoirs with a storage capacity of approximately 25,000,000,000 gal. of water. The company has 1408 miles of high-tension transmission lines; 950 miles of distributing transmission lines and 167 miles of underground cable in central San Francisco. The company has 16 gas plants, from which the output of gas in 1908 was 5,600,000,000 cu. ft. served through 1400 miles of main and 132,000 meters, supplying the entire city of San Francisco and more than 20 other cities and towns. Also the company owns several domestic water systems, 500 miles of canal for irrigation purposes, and the street railway system of Sacramento. With one small exception, the franchises under which the company operates are either without limitation in point of time or extend from 10 to 15 years beyond the life of the bonds. Many miles of right-of-way of transmission lines are owned outright.

The company's operations extend into 24 counties of central California, with an estimated population of 1,250,000. This is over 60 per cent of the population of California. Over 100 cities and towns are served by the company practically without competition. It is said that the gross earnings of the company have increased since 1906 at the rate of over $1,800,000 annually.

Annual Report of Department of Electricity, Chicago.

Some interesting statistics are contained in the twelfth annual report of the Department of Electricity of the City of Chicago for the year 1908, which has just been made public. The report is submitted by Mr. William Carroll, city electrician, to the Mayor and City Council. It relates to street lighting, fire and police alarms, electrical inspection and electrical construction done by the city. The financial statement shows that the total amount expended by the department in 1908 was $1,922,527. Of this $349,780 was spent for gas lighting, $187,667 for gasoline lighting and $68,833 for electric street lighting supplied from outside sources (principally if not entirely for lamps rented from the Commonwealth Edison Company). The great bulk of expenditure was for the operation and extension of municipal electric lighting for streets. The revenue earned by the department during the year was $171,226, the largest item ($98,855) being fees for electrical inspections. On Dec. 31, 1908, the city was operating from its municipal stations 9500 arc lamps and renting 744 arc lamps from the Commonwealth Edison Company.

It will be interesting to quote Mr. Carroll's exact language in relation to the cost of operating municipal street arc lamps. On this point the report says: "The average cost of the operation and maintenance of the 8602 lamps owned and operated by the city [average number during the year] was $45.86 per lamp per year, including all cash which this department paid out by voucher or payroll during the year 1908 for labor and material of all kinds, superintendence and office charges, but not including interest, depreciation, lost taxes, water rates, rent of office used by the city electrician in the city hall, rental of poles belonging to other companies and used by the city for wires and lamps, nor a portion of the cost of other branches of the city government which do more or less work for the electric lighting service, such as the Department of Finance and the Law Department—which charges, it is claimed, should be included in the cost of the city lights." The average annual cost of rented lamps was $78.75 for the year 1908. The present price of the Commonwealth Company is $75 per lamp per year.

As to the actual cost of the municipally operated street arc lights for 1908, Mr. Carroll gives a table adding to the "actual cash cost" the charges for water, rentals, office rent, taxes, insurance, depreciation, interest and proportion of other department expenses, which should be included to arrive at the true cost. These additional charges he figures at $28.26 per lamp, the largest items being $13.42 for depreciation, $10.73 for interest (at 4 per cent) and $4.03 for taxes. Adding this $28.26 to the "actual cash cost" of $45.86, the total actual cost of operating municipal street lamps is given as $74.12 per lamp per year. Compared with the cost of $78.75 for rented lamps ($75 at present), it is seen that the difference is slight.

The total cost of Sanitary District electrical energy consumed for municipal street lighting during the year was $72,044. Mr. Carroll points out that the improvement in the art and the purchase of power from the Sanitary District has made the old equipment practically valueless. In fact, he says that if the city can raise the money it will pay to put in modern equipment and scrap all the old dynamos and lamps and sell the old engines, boilers, shafting, etc., for what the material will bring.

The most important feature of the work performed by the Department of Electricity during the year has been the completion of the installation of the electrical machinery and apparatus whereby current has been taken from the Sanitary District of Chicago (generated at the hydro-electric power plant on the drainage canal at Lockport, Ill.) and used in place of steam for the operation of the municipal electric lighting system. The change has resulted in a reduction in cost of both operation and installation. Five street-lighting plants were operated by drainage canal electricity during the year and two others have been added since then and are therefore not included in the report.

A considerable amount of street lighting by gas is still carried on; but during the year 1902 gas lamps were discontinued on account of the installation of electric lights and 525 new gas lamps were placed in service. Gasoline lamps to the number of 671 were discontinued on account of electric lighting extensions and 534 new gasoline lamps were installed in outlying districts. The total number of gas street lamps in service on Dec. 1, 1908, was 21,200 and of gasoline lamps 7,013.

The city electrician is held responsible for the operation and maintenance of the fire-alarm telegraph system. During the year 1908 10,811 alarms were transmitted. August had the largest total of any month, with 1217 alarms. The city electrician also manages the police telegraph and telephone system. There are 44 police stations having police-alarm systems and all of these stations are connected to one another with a system of telephone circuits centering in the central station. During the year 77,547 alarms sent over the police telephone service were answered.

An important feature of the work of the department is the inspection of all electrical wiring and electrical equipment within the city. The Bureau of Electrical Inspection reports some interesting facts. One is that a smaller number of motors were inspected than in the preceding year, but that there was an increase in the average horse-power of installations. A large falling off in inspections of arc lamps is reported, which decrease is believed to be due to the number of tungsten clusters used.

The following table shows the number of electric lighting stations and lamps in the city under the jurisdiction of the department:

CHICAGO ELECTRIC LIGHTING STATISTICS.

	Stations.	Arc lamps.	Incandescent lamps.
Commercial companies, central stations....	24	18,973	2,322,097
Isolated plants	1,402	16,696	839,540
City plants, street lighting.....	5	8,602	.....
City plants, isolated, including water works	12	73	2,725
Totals	1,443	44,344	3,164,362

It will be something of a surprise to many to learn that there are 24 electric lighting concerns giving commercial service in Chicago. Of course, by far the most important of these is the Commonwealth Edison Company, the others being mostly what are known as "block lighting plants." One of these, the Gunther plant, is put down as supplying 10,000 incandescents, 300 arcs and 400 hp in motors.

Electric signs reach a total of 4753 and they are equipped with 286,484 incandescent lights.

The report on electric fires investigated by the Bureau of Electrical Inspection shows no appreciable fire loss from electricity. Nearly all of the electrical fires investigated resulted in nominal loss. The report concludes with a number of elaborate tables showing the electrical construction and maintenance work of the year. It makes a volume of 143 pages and is a creditable production.

CURRENT NEWS AND NOTES.

CHICAGO PASSENGER TRAFFIC.—For the year ended June 30 last the system of the Northwestern Elevated Company in Chicago carried 40,955,795 passengers. This is an increase of 3,536,509 over last year's record.

GUNNISON TUNNEL PROJECT.—The newspaper accounts of a hydro-electric development using the water from the Gunnison Tunnel, Colorado, are considerably in advance of any actual project. The best information obtainable states that the Government expects to sell power rights in the canal to the extent of about 1500 hp, but it would be probably much cheaper to erect a station in the canyon of the Gunnison below the tunnel where a large amount of power is available and where sites can be obtained by simply filing on the rights.

MOTOR MANUFACTURERS.—The next meeting of the American Association of Electric Motor Manufacturers will be held at St. Louis, Mo., Nov. 15-18, 1909.

THE PERMANENT MAGNET INVENTED.—A Chicago Sunday paper of recent date prints the rather remarkable statement that "Harriet Hosmer, famed as a sculptor, has invented the permanent magnet as a motive power. This is used in lifting large masses of metal."

CLUBHOUSES FOR TRACTION MEN.—The Interborough Rapid Transit Company has appropriated $50,000 to be used for the building of six clubhouses for its employees at various terminal points throughout Greater New York. It is expected that the houses will be ready for occupancy early in the fall. A subscription of $10,000 has been made by Mr. August Belmont for books, newspapers, etc.

SOCIETY OF AUTOMOBILE ENGINEERS.—The annual convention of the Society of Automobile Engineers will be held in Chicago at the Illinois Athletic Club on Aug. 5, 6 and 7. One of the sessions of the convention will be devoted to matters particularly relating to electric vehicles. Mr. F. J. Newman of the Woods Motor Vehicle Company of Chicago, made the local arrangements for the convention.

CIVIL-SERVICE EXAMINATION, U. S. INSPECTOR OF ELECTRIC LIGHT PLANTS.—The U. S. Civil-Service Commission announces an examination on Aug. 25-26 to fill a vacancy in the position of assistant inspector of electric light plants in the office of the Secretary of the Treasury at $1,800 per annum. A circular on the subject may be obtained by addressing the commission at Washington.

EXTENSION OF BALTIMORE CONDUITS.—The underground conduits for Baltimore are to be extended through a large part of the city and suburbs during the coming year. Mr. Chas. E. Phelps, subway engineer, has announced his intention of including $250,000 in his item of expense for conduit construction. This amount would equal approximately that of the work that was done during the past year. The superintendent of lamps and lighting, Mr. Robert J. McCuen, is most anxious to have the overhead wires placed underground, as it means a yearly revenue of $10 to the city for each arc lamp in use by the lighting company.

TAXES ON ELECTRICAL PROPERTY.—After a fight of a number of years the Consolidated Gas, Electric Light & Power Company has at last given the city of Baltimore a check for $399,475 in settlement of the city and State taxes on easements and structures. This amount covers the taxes which have been the subject of prolonged litigation since the year 1904, when for the first time the Appeal Tax Court entered assessments of this character against all of the public utility corporations. The main bone of contention rested in the valuation of the property which the court has assessed at $5,000,000.

LAW RELATING TO PUTTING TELEPHONE WIRES UNDER GROUND.—The village attorney of Salamanca, N. Y., has given it as his opinion that the municipal corporation cannot force telephone companies to put their wires under ground. He suggests, however, that relief may be obtained by residents of the village by the individual action of the property owners. By a recent decision (Osburn vs. Auburn Telephone Company) the law in New York State seems to be settled that individual owners have the right to prevent the erection of telephone poles upon their premises, notwithstanding any franchise right, unless they receive compensation.

ADVERTISING AN ELEVATED RAILROAD.—It is rather unusual for an elevated railroad company to advertise its service in the daily newspapers, and therefore it is of some interest to observe announcements of this character appearing in the daily papers of Chicago. The Chicago & Oak Park Elevated Railroad Company calls attention by means of display "ads" to the service it offers from the heart of Chicago to Austin, Oak Park and other suburbs. Newly painted stations and cars, a smooth roadbed, new 60-ft., 80-lb. rails and continuous rail joints are some of the attractive features of the road which are advertised.

DOMESTIC ELECTRICITY.—The Indianapolis Heat & Light Company has fitted up on the fourth floor of its office building a fully equipped and beautifully furnished five-room cottage in which is shown how a family can live by electricity. In the reception room there are electric lamps, electric fans, and an electric grate which heats the room. The parlor contains an electric piano which pounds out music when the button is touched. The dining-room contains any amount of electric apparatus, such as chafing dishes, coffee percolators, toasters and similar contrivances. The kitchen is equipped entirely with electrical apparatus for cooking, baking, washing machine, wringers, ice-cream freezer, irons and other devices. The sewing machine in the dining-room is run by electricity. The display is attracting much attention.

SPOT ELECTRICAL WELDING.—A patent relating to electric welding issued on July 20 to Mr. A. F. Rietzel covers the process of making welds electrically in spots for uniting sheets of metals in such a way that the result is similar to riveting. By means of raised portions on the sheets to be united the current and its heating effect are localized and a welding temperature is reached only at the spots desired. The application of mechanical pressure produces distinct spots of electically welded union of the plates separated by well-defined areas in which no union takes place. Advantage over continuous welding is claimed by reason of the saving in electrical energy and the elimination of burning of the metal. The patent, for which the application was filed on Feb. 24, 1905, has been assigned to the Thomson Electric Welding Company.

THE EDISON CONVENTION.—The program has just been issued for the thirtieth convention of the Association of Edison Illuminating Companies at Briarcliff Lodge, Briarcliff Manor-on-the-Hudson, Aug. 31 to Sept. 2. A number of valuable reports will be presented as usual, and a series of papers by well-known authors. The evening of Aug. 31 will be devoted to an address by Mr. Samuel Insull on combination lighting and railroad loads, with discussion. On the evening of Sept. 2 a dinner will be given to Mr. and Mrs. Edison by the association, and it is expected to have as guests also several of Mr. Edison's early associates in the lighting industry. The dinner committee is Messrs. Insull, Edgar and Lieb. This will mark commemoratively the thirtieth anniversary of the Edison incandescent lamp. Mr. W. W. Freeman, of Brooklyn, is president, and Mr. D. L. Huntington, of Spokane, secretary.

BALTIMORE SECTION, N. E. L. A.—Since the formation of the Baltimore section of the National Electric Light Association, consisting mainly of employees of the Consolidated Gas, Electric Light & Power Company, much enthusiasm has been shown by the members, which number 115, in the work of the association. The last meeting was held on July 16, with a full attendance. Mr. J. S. Cruikshank addressed the meeting on the subject of "Meters," illustrating his remarks with a number of different kinds of meters, which made the topic extremely interesting. Various points of installation, construction, maintenance, etc., were touched upon in the course of his remarks. The next meeting will be held Friday evening, Aug. 20, at 8 p. m., at the Consolidated Company's offices in the Continental Trust Building and will be addressed by Mr. Dorsey Smith, who will present a paper on "Incandescent Lamps and Lighting." Mr. F. Bonsal has been elected president of the section and Mr. Laurence Jones secretary-treasurer.

Municipal Lighting Plant at Jacksonville, Fla.

BY B. H. CLINGERMAN.

FOR almost 15 years the city of Jacksonville has been generating its own electrical energy for street and commercial service. The total cost of the original plant and lines, together with additions and improvements up to Jan. 1, 1908, was $523,567. There is at present no bonded indebtedness directly chargeable to the electric department of the city, the net earnings having been more than sufficient to cover the above amount.

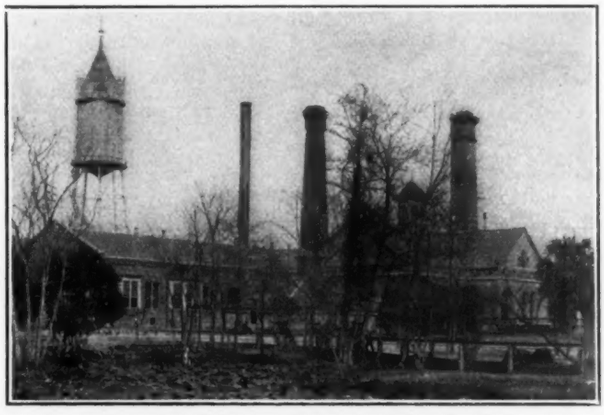


FIG. 1.—JACKSONVILLE ELECTRIC LIGHT AND WATER-WORKS.

The power plant (Fig. 1) is located about a half mile from the center of the city in the residence district. The ground immediately around the power plant and water-works has been converted into a very attractive park and presents a very pleasing appearance. The plant has a rating of 4000 kw in generators as follows: One 1500-kw and two 500-kw Allis-Chalmers steam turbines, one of which is shown during the course of erection in Fig. 2; one 500-kw Curtis turbine (Fig. 4); two 200-kw and one 100-kw DeLaval steam turbines (steam pressure, 200 lb.). There are also one 750-hp Filer & Stowell cross-compound Corliss engine belted to a shaft driving one 250-kw, three-phase generator with belted exciter, one 150-kw, 550-volt generator and three 150-lamp Brush arc machines.

Surface condensers are installed on and beneath the floor of the generator-room and an average vacuum of 27.75 in. is maintained. Centrifugal pumps are used for the circulating water.

The Allis-Chalmers, the Curtis and one of the 200-kw DeLaval units are three-phase, 60-cycle, 2300-volt machines; one 200-kw DeLaval unit is wound for 550 volts, and the 100-kw DeLaval unit is wound for 1150 volts, but the two generators are connected in series and operated at 2300 volts. The Brush arc machines will be shortly removed and the open arc lamps connected to these machines will be replaced with magnetite lamps, supplied with electricity from constant-current transformers and mercury-arc rectifiers. There is also a synchronous motor-generator set, the generator being rated at 275 kw, 550 volts, and the synchronous motor at 300 kw, 2300 volts, three-phase. This set is brought up to speed by an auto-starter.

There are three exciter compound-wound units; one 50-kw, 120-volt Bullock generator, direct-connected to a Ball engine; one 25-kw Curtis turbine unit (operating non-condensing), and one 50-kw Allis-Chalmers induction motor-generator set. Two constant-current transformers are used with the mercury-arc rectifiers and are wound for 2200 volts primary and 4 amp, 4500 volts secondary. Three 42-kw and two 21-kw constant-current transformers are used for 4-amp alternating-current arc lamps.

The boiler capacity of the plant is 3200 hp, made up of two 500-hp Stirling, one 350-hp Aultman & Taylor, two 350-hp, three 250-hp and two 200-hp Babcock & Wilcox boilers. The piping is so arranged that the DeLaval turbines can be operated at 200-lb. steam pressure from one of the 350-hp B. & W. boilers. The plant is normally operated at 150-lb. steam pressure with 70 deg. superheat. Two 750-hp Cochrane feed-water heaters are in use. Three feed-water pumps (Worthington upright duplex, Knowles duplex and Union Steam Company's simple pumps) are connected between the heaters and boilers, but can be used to pump directly from the hot-well. Circulating water is secured from a creek near the plant. Condensation is returned to the boilers from the hot-well.

Changes have about been completed for burning crude oil under the boilers. The bridge wall in each boiler had to be moved back about 2 ft. and the burners were placed on the front face of the bridge wall. The flame is directed forward against a brick wall erected just behind the fire doors. The oil and steam are mixed at pressures of 60 lb. and 40 lb., respectively. A Custodis radial brick stack, 125 ft. high and 10 ft. internal diameter, has been erected to replace two of the stacks shown in Fig. 1.

Cypress poles are used almost entirely on the overhead lines because of their low cost and durability. Although they are porous, the company's linemen make the usual connections on the poles with normal voltage maintained on the wires excepting during a heavy rainstorm. In some cases where the insulation on the wires is subject to abrasion on account of the trees, a rubber-covered wire, protected on the outside by a heavy net-like copper sheath, has been erected.

The system of distribution for lighting is single-phase, the three phases being balanced at the switchboard. The motor circuits are three-phase alternating current and direct current at 550 volts. All new motor load is taken care of by the installation of alternating-current motors. The total rating of motors connected to the lines is 800 hp. The total rating of transformers is 3674 kw. There are in service at the present time 200 magnetite lamps, 325 alternating-current 4-amp arcs and 150 direct-current open-arc lamps. The magnetite lamps have replaced direct-current open-arc lamps for street lighting and the remaining 150 direct-current lamps used for commercial lighting will be removed shortly.

It is interesting to note in this connection that the company has had rectified tubes giving as high as 2700-hours' service, while some tubes broke down shortly after they were installed. The average life, however, is good. In several cases the tubes filled with oil owing to the unequal expansion between the metal and the glass in the terminals while hot, but upon cooling the oil became sealed in the tube. Some trouble was caused by the mercury becoming mirrored upon the glass early in the life of the tube, causing a short-circuit and rendering the tube useless.

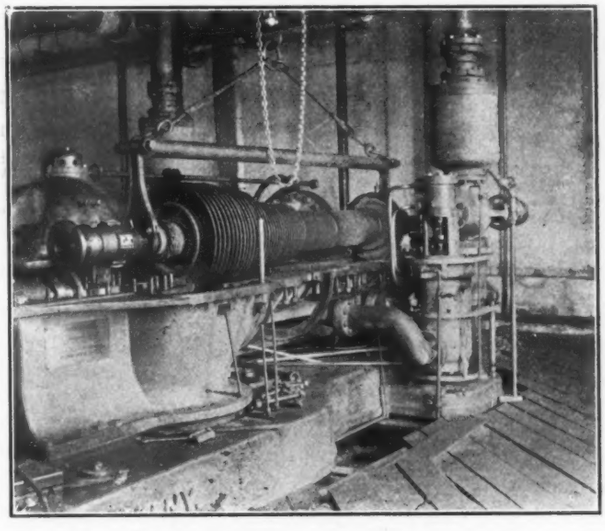


FIG. 2.—HORIZONTAL TURBINE IN COURSE OF ERECTION.

Approximately 166 50-cp series carbon lamps will be replaced

with 75-watt tungsten lamps. Ninety-nine two-lamp ornamental iron posts were recently erected for lighting one of the thoroughfares of the city. The installation was provided by the property owners and the electrical energy furnished by the city. The lamps are 60-watt multiple tungstens. The total

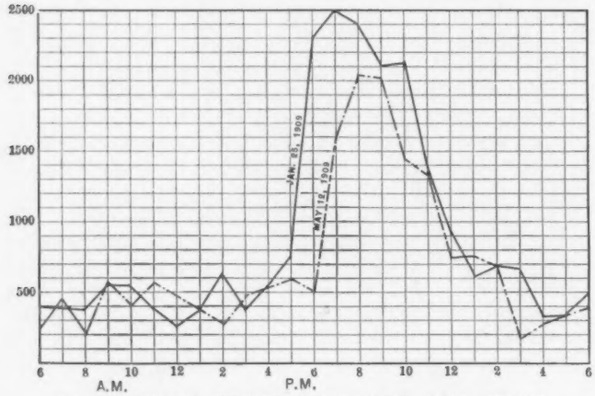


FIG. 3.—TYPICAL WINTER AND SUMMER LOAD CURVES.

load for 24 hours in the winter and summer is shown in Fig. 4.

The original use of wood was discontinued for a mixture of No. 3 anthracite with 30 per cent bituminous coal. This gave an excessive amount of ash and it was found that No. 2 anthracite and 18 per cent bituminous coal gave better results. For some time West Virginia run-of-mine has been used with a resulting consumption of 4.5 lb. of coal per kw-hour generated. The boilers are being equipped for burning crude oil

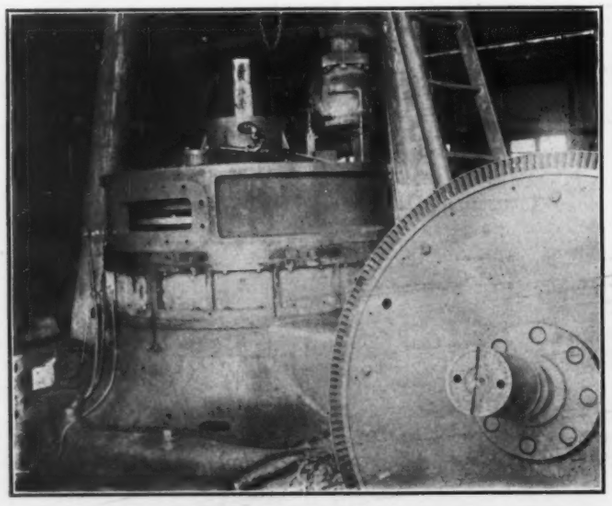


FIG. 4.—VERTICAL TURBINE BEFORE COMPLETION.

(Fig. 5), which gives a better economy than West Virginia run-of-mine at $4.10 per ton, hand-fired.

The following statistics are submitted in advance of the report for 1908:

Gross earnings (including revenue from city for street lighting)	$298,039.90
Operating expenses not including taxes	$179,739.61
Net earnings	$118,300.29
Ratio operating expenses to gross earnings	60 per cent
Gross earnings per capita	$4.60
For additions and extensions	$80,615.80
Turned over to city treasurer	$20,000.00
Total kw-hours generated	6,074,779
Cost of fuel per kw-hour	1.3 cts.
Cost fuel and labor at power plant per kw-hour	1.7 cts.
Operating expenses per kw-hour	3.0 cts.
Gross earnings per kw-hour	4.7 cts.
Load factor for the year	30 per cent
Number of meters in service	4,650

RATES.

Arc lamps, all night	$90
Commercial lighting, per kw-hour	7 cts.
Minimum charge per month	$2
Motor circuits sliding scale per kw-hour	7 to 3 cts.
Minimum charge for elevator motors per month per rated hp	$1

The board of bond trustees exercise a general supervision over the electric department, but the actual management rests with the superintendent, Mr. R. N. Ellis. The length of time during which the officials and heads of departments have been connected with the operation of the plant, seems to substantiate the statements of the employees to the effect that politics does not enter in the management of the property.

Central-Station Development at Lawrenceville, Ill.

The plant of the Lawrenceville Light & Water Company, at Lawrenceville, Ill., furnishes an example of unusually rapid growth due to certain local conditions, and also illustrates the effect of good service and proper engineering in converting a losing central-station property into a paying one.

HISTORY.

The plant of the Lawrenceville Light & Water Company was built in 1898, a 30-year franchise having been granted in 1897. It is a combined electric light and water-works plant. As the population at Lawrenceville according to the 1900 census was only 1300, it will be seen that the changes of profit for such an undertaking were not very great.

The electric part of the plant was built for a direct-current, 220-volt system. There were two 250-volt compound-wound generators direct-connected to high-speed engines, one generator being 30 kw and the other 20 kw. Water for the water-works system and boilers was supplied from two steam deep-well pumps, one drawing from a 200-ft. well inside of the power plant and another from a 250-ft. well outside the power plant, but on the same piece of land. These pumped to a surface

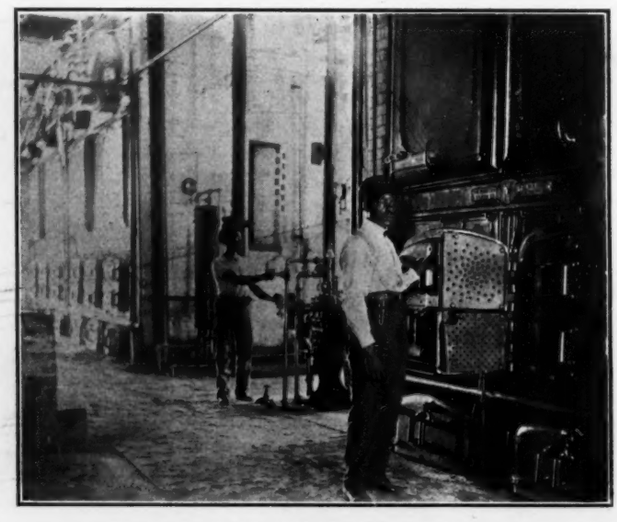


FIG. 5.—BOILERS EQUIPPED FOR BURNING OIL.

reservoir, 50 ft. in diameter by 14 ft. deep, having a capacity of about 74,000 gal. From this surface reservoir the water was forced into the mains and for storage two 1875-cu ft. air-pressure tanks were installed, these tanks being connected to the mains and kept half full of air under pressure to make it possible to discontinue pumping for short periods. A duplex steam fire pump pumped from the reservoir into the mains and pressure tanks. The boiler plant consisted of two 45-hp Erie boilers. Later a motor-driven deep-well pump was placed in a well at some distance from the power plant for the purpose of pumping directly from a deep well into the mains.

The net result of operation for the first 10 years was a considerable loss to the owners. This was caused no doubt during the first part of the period by the fact that the population was insufficient. During the latter part of the period the population was rapidly increasing, but the previous losses on the plant had resulted in its being allowed to run down to a point where reliable service was impossible.

In February, 1908, the control and management of the prop-

erty changed. The new management found a town which was rapidly increasing in population on account of the oil fields which were being opened up in Lawrence County. The oil deposits in Lawrence County are the deepest and richest of any in the State. Natural gas had also been discovered and piped into the new town. Competition with natural gas, retailed at 30 cents per 1000 cu. ft., doubtless had much to do with discouraging the previous owners as to improving the electric light

FIG. 1.—POWER HOUSE AND LAND, LAWRENCEVILLE.

service, and also prevented a number of electric light men who investigated it from taking up the proposition. The new management, however, knew from experience elsewhere that cheap natural gas does not by any means prevent an electric light and power company from prospering if the management is progressive and enterprising. The experience of 18 months has fully demonstrated the correctness of this theory, as gas lighting is very little used, and the only difficulty the company has experienced is in keeping up with the rapidly increasing demand for electric light.

The condition of the plant called for immediate and radical improvements in order to give reliable service and take care of such increase in business as would bring the gross earnings up to a point where the venture would be profitable. The 220-volt direct-connected engines and generators were in such a dilapidated condition that breakdowns were of weekly, and sometimes nightly, accurrence. The copper in the 220-volt, direct-current distributing system was insufficient and a voltage loss of 25

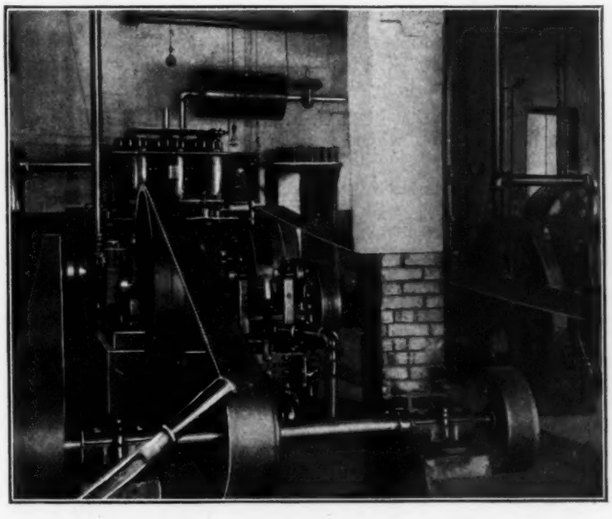


FIG. 2.—GAS ENGINES, PUMPS AND COMPRESSORS.

per cent between the power plant and the ends of residence lines existed during peak load.

Electric service was being given only from dusk until midnight—another point which made electric light unpopular. At the same time it was necessary to keep an operating engineer at the plant 24 hours a day on account of the water-works service. One deep-well pump with steam cylinder directly on the pump rod was kept in operation 24 hours a day. The monthly coal consumption was from 90 to 100 tons of coal, costing $2.25 per ton, delivered, resulting in a fuel bill which was absurd, considering the meager service obtained from the coal burned. A test in February, 1908, revealed the fact that out of the 24,000 gal. a day pumped to the water-works reservoir approximately one-third was used in the boilers of the plant itself. At that time one of the two 45-hp Erie boilers had been replaced by a 100-hp horizontal return-flue boiler, and this large boiler was the one ordinarily operated.

RECONSTRUCTION.

It was decided to change the electric lighting system from 220 volts direct current to alternating-current, single-phase, 60-cycle, with 2200-volt primary distribution, feeding into three-wire, 218-volt and 109-volt secondaries. It seemed a very opportune time to make the change, inasmuch as comparatively few meters had been installed and the direct-current generating apparatus was nearly worn out. With the alternating-current system it would be an easy matter to extend the lines to new portions of the town, which before had no service. The management also had in view the building of a single-phase, 10-mile, 10,000-volt transmission line to supply electricity to Bridgeport and Sumner, in the same county. Single-phase distribution was selected because the distribution system is simpler and less expensive than polyphase, which more than counterbalances the extra cost of the single-phase motors.

As to prime movers, in view of the existence of cheap natural gas of excellent quality, it seemed best to install a gas engine to give 24-hour electric service, and to pump most of the water. At the same time it did not seem wise to throw out the existing boiler and steam-pump equipment, which afforded a cheap reserve for peak and other loads. The first change made was to enlarge the building so as to permit the use of belt-driven alternators with 25 ft. to 30 ft. belt centers. For the first unit a gas engine of 85 hp was selected as being the size best fitted to the probable load for 24-hour operation of electric service and water pumping. A three-cylinder Nash engine of this size, running 243 r.p.m., was purchased and belted with a 14-in. belt to a 50-kw, single-phase, 2200-volt Westinghouse alternator running at 900 r.p.m. From the other end of the engine was run an 8-in. belt to a line shaft with a tight and loose pulley on the shaft to permit the shaft to be stopped while the engine is in operation. From this line shaft is belted a triplex pump rated at 76 gal. per minute at 50 r.p.m. This pump is equipped with pulleys of such size that it usually gives the necessary capacity to

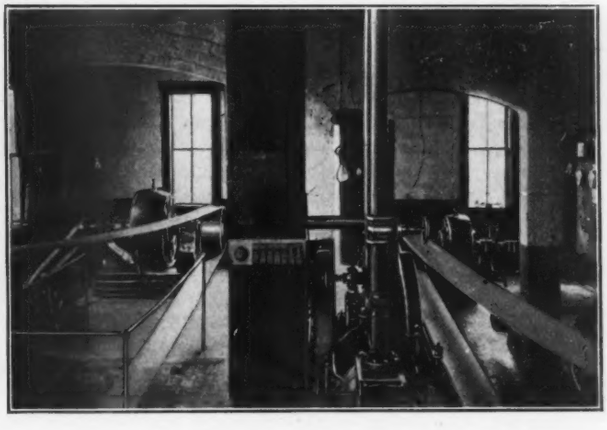


FIG. 3.—BELT-DRIVEN ALTERNATORS.

supply the regular daily needs of the water-works by being operated continuously except during the peak of the electric load. There is also belted to the line shaft a Laidlaw-Dunn-Gordon air compressor, rated for a capacity of 137 cu. ft. of free air per minute at 150 r.p.m. against a working pressure of 100 lb. per square inch. This air compressor was installed for air lift, deep-well pumping, so as to abandon the pumping of

deep wells by means of troublesome deep-well pumps, which were giving frequent trouble on account of the pulling apart of rods or leakage of pump pistons. These rods and pump pistons being located deep in the wells, repairs were expensive and troublesome. Although motor-driven deep-well pumps would probably have been more economical than air-lift pumping, it was considered that with cheap power obtained from a gas engine (which gas engine would be operating in any event to give electric service) it would be almost as economical and more reliable to use air-lift pumping and avoid all moving apparatus in the deep wells. The experience of the year has fully borne out these conclusions.

The 85-hp gas engine is only shut down for regular inspection and cleaning of igniter points once a week. This engine, although of high cost per kilowatt, operates at a very much lower fuel cost than would a steam pump. At the same time, the investment is kept down by utilizing as much as possible of the existing steam plant. The 100-hp boiler and one of the 45-hp boilers were kept in service and piped to use natural gas. The other 45-hp boiler is used as an air-storage reservoir for the deep-well, air lift and for starting of the gas engine. A second-hand steam air compressor was purchased, which furnishes a reserve for air compression. The steam-pressure pump for pumping from the reservoir into the mains and for maintaining extra pressure during fires was unchanged except for a general overhauling.

For an electric reserve and for carrying peak loads a 75-kw, single-phase Fort Wayne alternator belted to a Harrisburg high-speed, four-valve engine was installed. This gives a much lower investment for reserve capacity than if an extra gas-engine unit had been installed.

Two alternators are now regularly operated in parallel during peak load with no difficulty whatever. The compensating winding with which they are equipped, however, is cut out when they are operated in parallel.

It is the intention to use gas engines for future enlargements of the power plant. There is, of course, the possibility that the natural-gas supply will give out in the course of time, but should this occur gas producers can be installed, as space will be left for them adjoining the engine. The power plant is now so arranged that it can be enlarged unit by unit by simply adding a new section to the building without disturbing the machinery already in place. The power plant is shown in Figs. 1, 2 and 3. It is of brick and concrete, with brick and concrete floors and slate roof.

In changing the distribution system the first step was to run the primary mains and connect the primaries of transformers. On account of the large amount of copper in the 220-volt distributing system, it was decided best to install but a few large transformers with their secondaries feeding into the previous 220-volt system. After this change was made a neutral secondary wire was installed and connected to the neutral of the transformer secondaries. Consumers were changed one at a time from 218-volt to 109-volt service, and those desiring to use tungsten lamps, electric flatirons or electric fans were changed first. Most of the 220-volt commutator-type Thomson meters were sold to other companies operating 220-volt, direct-current circuits. All new consumers and all those changed to 109-volt service are supplied through Westinghouse induction watt-hour meters with glass cases. The theory of the management is that glass-case meters are more likely to receive careful treatment at the hands of employees and less likely to present a dilapidated appearance after several years of use.

Along with the change of the secondary distributing system from two-wire to three-wire, considerable copper was taken down between the power plant and the center of the town, a distance of 1200 ft. Some of this copper was installed in other places. The secondary distribution system is divided into sections, each transformer feeding a section. Between sections fuses are inserted, these fuses consisting simply of bare copper wire wrapped around the ends of the adjacent sections, which are dead-ended at the fuse. The idea of these fuses is, of course, to enable one transformer to assist in carrying the load of another in case of a temporary heavy load at one point. If the load on one transformer causes its primary fuses to blow, the secondary section fuses connected to its section will also blow and isolate the trouble without allowing it to spread to other sections. Otherwise the blowing of one transformer fuse would necessitate a complete shut-down of the whole system until all primary fuses could be replaced. The total kw equipment in transformers June 1, 1909, was 73.5, ranging from 20 kw to 3 kw.

The neutral wire is made continuous over the entire system, and the section fuses are inserted only in the outer mains. The neutral is grounded at a number of points to the company's water-pipe system as a precaution against dangerous voltages getting on the secondary circuits.

On a number of streets joint pole construction with the telephone company is used. (Fig. 4.) Under the joint-pole contract the telephone company builds a pole line and the electric light company pays 10 cents per year per wire contact per pole, the maximum being eight contacts per pole, not including branches, and the maximum price is 40 cents per pole. The electric light wires are placed on the top cross-arm so that the breakage of telephone wires in sleet storms will not produce a dangerous condition.

GROWTH.

On Feb. 1, 1908, the company had 86 electric consumers and 100 water consumers; June 16, 1909, it had 251 electric consumers and 333 water consumers. This unusual growth can be ascribed to a number of causes. The plant before reconstruction was too small to carry any more load, and the service was so poor that although many people wanted electricity they were discouraged about putting it in. As soon as the public began to appreciate that the change in management and apparatus meant reliable service, those who had been holding off took electric service. The town in the meantime had been growing rapidly as the result of activity in the oil fields. The population on May 1, 1909, as estimated by school attendance, by post office and by bank transactions as compared to the year 1900 was at least 3500, or about 2.7 times the population in 1900, and to judge from building activity in the town the rate of increase is now more rapid than ever.

Besides good service and growth of population, the existence of a live contractor in the town doubtless had an influence on the growth of the business. The company and this contractor, Mr. A. R. Lewellen, co-operate in every way possible. The company did not enter the contracting field until the winter of 1909, about a year after the present management took hold. The policy is to encourage independent contractors, but to be prepared to give consumers good service in the way of electric wiring and supplies when so requested.

The fan business has been one of the most remarkable features in the growth of this system. The company began to give day service in July, 1908. Before the service was begun, and in expectation of it, 43 fans had been sold. One year later, June 15, 1909, there were about 85 fans out. The electric flatiron business during the summer season of 1908 was somewhat interfered with by the fact that part of the residence consumers had not been changed to 109-volt service. However, 20 electric irons were put out the first season, only one of which was returned and that because the consumer was about to move away. Forty electric irons were put out on trial the beginning of the warm weather in 1909, making 60 in use in all. It is expected that but few will be returned, in view of the small percentage on the first lot, and that 100 will be in use by September.

In the lighting of stores three gasoline plants formerly in use have been displaced by tungsten lamps, and the company is doing nearly all the lighting of the business part of the town. Mantle maintenance with natural gas prevented its extensive introduction and in warm weather the heat from gas is further detrimental.

The company's most active efforts for getting new business have been to secure non-peak and day load, as the peak lighting load has come easily. The company's own water pumping gives its plant a good load factor, probably in the neghborhood of 40

per cent. There is not a large amount of steady power business to be obtained in the town. A 7.5-hp electric motor has displaced a 10-hp gasoline engine in a planing mill, and the total connected motor load is only about 15 hp, but small motors for various uses are being gradually connected, and in cases where it seems best will be put in on trial. Only single-phase motors with commutator-type starting devices are allowed over ½ hp to keep down disturbance due to starting current.

RATES.

The rates, which were put into effect June 1, 1908, were considerably below the rates permitted by the company's franchise, which allows a rate of 20 cents per kw-hour. Before the present management took hold the rates had already been reduced to 10 cents per kw-hour. On account of the natural gas competition and also because of the unfavorable sentiment aroused by raising the rates, 10 cents per kw-hour with a minimum bill of $1 per month was allowed to stand as an optional rate on all classes of lighting business. This is termed the company's "single rate."

The consumer is given the option between this and a "multiple rate," which, for lighting, is as follows: 15 cents per kw-hour for electrical energy used equivalent to one hour's use per day, or 30 hours' use per month, of a consumer's maximum demand, the maximum demand being estimated by the rules given later. For electrical energy used in excess of this one hour's use per day and less than two hours' use, the rate is 6 cents per kw-hour. For electrical energy used in excess of two hours' use, the rate is 5 cents per kw-hour. The minimum bill is $1 per month on this rate also.

The rules for estimating the maximum lighting demand are as follows: For stores, offices, depots, etc., where all lamps are lighted during the company's peak-load period (that is, from 5 to 6 p. m. in winter) the maximum demand shall be counted as the full connected number of lamps. For residences the maximum demand is counted as 40 watts for each room in the house, irrespective of the connected load, exclusive of bathrooms, basements, porches, stairways, attics, storerooms, small halls, entrances, woodsheds and barns. In effect, this means that the number of rooms counted is multiplied by 1200 watts to give the monthly amount charged at the rate of 15 cents, the next equal amount being charged at 6 cents and the remainder at 5 cents. The maximum demand for churches, public halls and theaters, not usually on during heavy load hours, is taken as one-half the connected load. Hotels and boarding houses are also figured as having a demand of one-half the connected load.

For power the company's single rate is 8 cents per kw-hour with a minimum bill of $1 per horse-power per month. The multiple-rate system for energy for motors is 13 cents per kw-hour for that used equivalent to one hour's use per day of the consumer's maximum demand; 5 cents per kw-hour for energy used in excess of that, and up to the equivalent of two hours' use per day of the maximum demand. The remainder is billed at 4 cents per kw-hour. Fifty per cent discount is given on those portions of these multiple-rate power bills in excess of $50 per month. There is a minimum bill of $1 per horse-power of motor rating per month. The maximum-power demand on this rate is assumed to be 1 kw per horse-power rating of motor, except where a motor is much underloaded and the consumer desires a test. In such a case the company will make a test for such period as seems best to determine the real maximum demand.

The company has a non-peak rate to consumers who agree not to operate motors between 4:30 and 8 p. m. during November, December, January and February. These consumers are given the multiple rate, with the 13-cent portion reduced to 7 cents. The rates apply to motors of over ½ hp. Smaller motors are put on lighting rates.

As regards store lighting, the rates present nothing novel. In residence lighting, however, the method of reckoning is unusual and believed by the management to be the best adapted to residence lighting conditions in small towns of any system yet devised. The principle of charging a high rate for the first portion of a consumer's use of electricity in order to cover the fixed charge on the investment needed to serve a consumer is now generally recognized and has been put in practice by most of the larger and many of the smaller companies. In applying this principle to residences it has been customary to base the amount of the primary or higher charge on the actual connected load in lamps. This company believes that there are some serious drawbacks to this plan, because every socket which a consumer has in his residence, no matter how infrequently used or how little influence it has on the actual maximum demand, is counted against the consumer in the shape of higher rate. It is believed that estimating maximum demand according to the principal occupied rooms of a house comes fully as near to distributing charges equitably among the different consumers as a plan based on the number connected. Under the plan of counting according to the rooms, the consumer can put in as many lamps as he wishes in various convenient places without affecting his rate, and this has the effect of increasing the monthly kw-hour consumption per consumer. One of the advantages of the multiple rate is that it gives the users of flatirons, fans and heating appliances a low rate on these devices without the installation of a special meter. Flatirons and other appliances which are seldom turned on during peak load are not counted in making

FIG. 4.—JOINT POLE CONSTRUCTION, LAWRENCEVILLE, ILL.

up the consumer's maximum demand, so that the energy used by these devices is billed at the low rates of 6 and 5 cents.

The company recommends to the consumer whichever rates it considers will be the most economical for the customer. At the time the change to the new rate was made, since it was impossible to explain to every customer the two systems, all consumers were billed the first month at the straight 10-cent rate and were gradually changed to the multiple rate, as it appeared to the manager that it would be desirable for them to do so, or as requests were made. On Feb. 1, 1909, about three-fifths of the residence and three-fifths of the commercial consumers were on the multiple rate.

Another advantage of the multiple rate is that it tends to equalize the consumers' bills from month to month. In other words, the consumer pays a higher average rate per kw-hour in summer than in winter, which has a tendency to reduce complaints about high bills which come during the fall and winter months.

STREET LIGHTING.

The town was formerly lighted with 32-cp, 220-volt incandescent lamps. As additional street lighting was wanted about the time the present management took hold, it was recommended to the city that series tungsten lamps be used as being best suited to the lighting of a town of this kind where an arc lamp on every corner is out of the question. As local sentiment seemed to be so strongly in favor of arc lamps at that time, the company finally accepted an order for 15 6.6-amp, enclosed, alternating-current series arcs at $65 per year, all-night, every-night schedule. For additions to the street-lighting system which are to be made in the immediate future, it has been decided to use 55 100-watt, 80-cp series tungsten lamps. With the infrequent spacing which is necessary in a town of

this kind, the series tungsten can be made to give far better results, as was shown by a practical demonstration made by the company on one of the streets where one of these 100-watt lamps was placed on every corner for a distance of three blocks, the blocks being 300 ft. in length. The illumination thus secured was far better than the average in towns of this size.

FINANCES.

The liabilities of the company May 1, 1909, were as follows:

Capital stock (common)	$32,000.00
Six per cent first mortgage bonds	15,000.00
Floating debt, notes issued account construction	5,630.40
	$52,630.40

The capital is being increased to take care of the rapid growth of both public and private service which is demanded. To illustrate the immediate results of the reconstruction two equal periods of seven months before and after Sept. 1, 1908, show operating figures as follows:

Seven months, Feb. 1, 1908, to Sept. 1, 1908:	
Collected earnings from operation	$2,862.65
Operating expenses and bond interest	3,504.98
Deficit for period	$642.33
Seven months, Sept. 1, 1908, to April 1, 1909:	
Collected earnings from operation and supplies	$6,836.56
Operating expenses, bond interest and supplies	4,124.06
Net earnings for period	$2,712.50

No depreciation is included in these figures. The fuel bill after reconstruction was considerably less than it was under the old arrangement with half the volume of business.

The property is managed jointly by Mr. J. R. Cravath, of Chicago, president, and Mr. Cale R. Gough, secretary and manager, who has had immediate supervision of construction and operation.

The Selection of Towers for High-Tension Transmission Lines.

By N. J. Neall.

In an article which appeared in the first issue of the *Electrical World* in July, 1909, an outline was given of the conditions encountered by towers in high-tension transmission lines. A study of these conditions permits one to assign the general dimensions to towers and to select the proper towers for specific installations.

Assuming that the telephone wires are to be carried on the same tower as the transmission wires and remembering that under the various weather conditions assumed, the respective deflections of the copper cable and the telephone conductors will not be identical, no less than 9 ft. at the tower between the telephone conductors and the nearest line wire is possible if a minimum clearance of 3 ft. is to be preserved between these groups of conductors at any point of the span for the worst condition—that is, maximum temperature with maximum wind. Assume further that the telephone conductors are strung in parallel on 2-ft. centers and are transposed at every tower. This arrangement will require a tower approximately 49 ft. from the ground to the lowest main conductors.

The main conductors are to be arranged in the form of an equilateral triangle with the apex upward 7 ft. on a side. Above these are to be suspended, in the same horizontal plane, two overhead grounded wires so arranged as to extend at least 2 ft. above the plane of the top wire and approximately 1 ft. outside the plane of the two lower line conductors. The overall height, exclusive of any lightning rods that might be employed, would be approximately 57 ft.

Two classes of towers are to be selected: a dead-end form and one of considerably lesser strength. In the former, provision will be made to hold the respective conductors so that they cannot slip, while in the latter only so much friction will be required of the tie wire at insulators as to keep the main wire in place. It will be expected that with any failure in the main transmission wire which causes it to rupture, successive spans will automatically lengthen out sufficiently to take up the new strain. If the wire should touch the ground, the added friction will be very helpful; however, the chances for fusing away the conductor on testing the short-circuit may require great care in operation.

The respective maximum dead-end loads thus imposed on a tower by a standard span are as follows:

Two 2050-lb. telephone wires	4,100 lb.
Three 3000-lb. main conductors	9,000 lb.
Two 2610-lb. overhead grounded wires	5,220 lb.
Total	18,320 lb.

In the ordinary construction to-day no such loads as those just listed could be taken care of, however strong might be the tower, unless the insulators and their supports are adjusted accordingly.

The effective working strength of an "extra heavy" steel-pipe insulator pin suitable for a 14-in. x 14-in. insulator for 60,000 volts may be taken as 1500 lb.; while tests on insulators with solid-steel pins give a shearing or crushing strength of the insulator at approximately three times this value, yet the moment a metal pin begins to bend the insulator is destroyed. It will thus become apparent that for dead-end tower work or for support resistance against any unbalanced span, there must be as many pins in tandem as the respective conditions of span strain and individual-pin strength may require. It will be obvious that the mere accommodation of these extra pins, with the accompanying insulator clearances, calls for extra spacings and additional material and thus considerably increases the cost of the tower. Fortunately, once a line is erected, the pins in general have only the wind loads and dead weights to take care of, for the adjacent spans being nearly identical the strains balance each other at the point of support. Where adjacent spans are of unequal length or where two adjacent spans are at an angle with one another, the unbalanced forces require the same consideration as in dead-end spans. The insulator pin is thus the weakest point in the tower elements requiring assemblage, and must be so recognized to secure a satisfactory tower.

The usual form of tie used in transmission work consists of a comparatively small wire of the same material as the main conductor. In the present case it will be soft copper. The very best workmanship can probably not create a friction hold between the insulator, cable and tie wire that will prevent the cable slipping at, say, a maximum of 1000 lb., and the average will doubtless be much below this value. For this reason, where dead-end holds are required, use must be made of some other form of tie, such as plates or clamps tightened together with bolts and nuts, etc.

The kind of tests to be required on the respective towers can now be differentiated.

Dead-End Tower.—This tower must withstand, without failure of any sort, simultaneously and correctly imposed by each of the conductors as to angular position, etc., the maximum strains to which they may subject it. At the same time the tower itself must withstand such wind strains on the structure as are contemplated in the attending circumstances and have a factor of safety of at least 1.5; that is, each of the strains could be increased 50 per cent without failure of the tower.

In practical work this requirement would necessitate a comparatively heavy tower, so that in the major part of the line layout the following change could probably be made satisfactorily without any serious decrease in effectiveness. The overhead grounded wires have a much greater ultimate strength and have likewise a much higher elastic limit than have either the main conductors or the telephone wires. For this reason they may be provided with such firm fastenings to the towers as to furnish what is in effect an overhead anchorage. This fact immediately enables the other conductors to be assembled with less rigidity, certainly with a lighter tower to perform the same service.

Supporting Towers.—This tower differs from the modification last mentioned only in the degree of tie strength, and it may in general be considered as a single-insulator-group-tie-wire form. If the overhead grounded wire were not used, the difference between the two on this account would be much greater.

Having thus considered the fundamental features involved in a case for straight runaway requirements, specifications may be

arranged for estimates by tower builders. The following points should be noted therein:

Details as to proposed span; size of wire; proposed arrangement of conductors; insulation clearance requirements; number of towers per mile; general nature and topography of country through which line is to run; character of soil; facilities for shipment and distribution; and accessibility of materials for concrete.

Type of Tower.—Single-circuit or multi-circuit type; width of prospective right-of-way and permissible maximum dimension for tower base; general shape of tower desired.

Type of Anchorage Proposed.

Conductor Strains.—These consist of (1) those estimated for dead-end work; (2) those estimated for support only; (3) the maximum wind pressure assumed, and (4) the two extremes of service to be met, namely, sleet with moderate wind, cable only with maximum wind, the wind being in a direction perpendicular to the line.

Materials.—Care should be exercised here to obtain the best quality of material, because of the light sections generally used and the sudden shocks which the structure must withstand. This means that there should be not only acceptance tests on tensile strength, etc., but also chemical analyses. The amount of rust should be carefully noted, and if rust started considerably before the machining begins, the material should be discarded. There will probably be more attention paid in the future to the now recognized inherent tendency of certain types of steel to rust easily, and this attention, with proper cleansing before either galvanizing or painting, will have much to do with the increased life of the tower material.

Defects in rolling, etc., are easily recognized and a good inspector will not pass them.

All pin material should be given a bending test, on selected samples, particularly if use is made of pipe formed into pins by the hot process. All parts should be interchangeable. In the event of galvanized finish all machining must be performed first. If painted, the number of coats to be furnished at the factory should be specified.

Weight.—This is a figure dependent very largely upon the individual designer, but a limit can soon be ascertained. This value is, of course, considerably affected by the customer's requirement. In general, competition, if it does anything, will tend to keep the weights within reasonable bounds. The adequacy of any design can be fully covered by proper test specifications.

Factor of Safety.—This is a troublesome detail and likely to be hazy. In general it might be considered in a two-fold way. In the first case, under severest working conditions, with, say, maximum wind, the tower and cables complete should be able to withstand at least 1.5 times the respective calculated loads applied simultaneously at every point. Secondly, the tower itself merely as a structure for the support of the conductors and resistance against overturning should certainly have a factor of safety of at least 2. The assumption is made in all these requirements that the anchorages are rigid; unless heavy concrete foundations are used, this is not strictly true; in fact, there may be considerable "give," but since the possibility is most remote that the leverage will affect less than two such anchors simultaneously, a considerable tenacity in holding down is obtained. The tower is therefore likely to fail by buckling. If for any reason the ground under a tower should not be firm enough to support the structure, then arrangements must be made accordingly.

Inspection.—Careful inspection of material, workmanship, etc., in the shop is the very best means of assuring a satisfactory tower. No order of importance should be without such consideration.

Tests for Acceptance.—The value of acceptance tests is not so generally understood as one might desire. The general tendency in tower tests is to arrange for the application of given loads at the insulator-pin heads and then only certain groups are tested simultaneously. No test representing wind loads is made simultaneously on the tower itself. Acceptability generally depends on the ability of the structure to remain rigid or at least to deflect from the vertical by only a small amount. When one considers, however, the variety of possible ways in which a tower can be affected, such a test seems but a feeble approach to certain bad actual conditions. The application of a load in this manner may be perhaps taken as approximating broadly to the resultant stress for a given case, but owing to the complicated form of the structure it is clearly far less direct or indicative than a simultaneous application of known constituent loads to the various parts of the tower. Even here certain assumptions as to the points of application of local pressure resultants must be made, but owing to their distribution and number being greater than in the former single application, the degree of reliability is certainly much enhanced.

In addition to the tests noted, there is also the important condition of torsional stress on a tower which is caused by the failure of only a part of the total number of conductors. A tower might be very ably designed for the condition of sleet load with wind, etc., and likewise for the maximum wind conditions, either in a plain support or dead-end form, but if to the latter the above condition of torsional stress is added, the tower may still prove weak. Proposed methods for ascertaining fully all these characteristics are as follows:

The tower may be placed vertically in position on firmly fixed anchorages and to the various insulator-pin head and panel corners, cables, each supplied with a dynamometer, are attached. The cable should then be subjected to tension in the proper direction and amount up to the required number of pounds. While such a test is theoretically feasible and more nearly approaches the real condition, it is difficult and expensive to apply. According to a second test the tower is placed horizontally and held rigidly by appropriate means. Weights are then applied at the proper points as required. This test is a very simple one to make and will determine fully the characteristics of the tower.

Costs.—Scholes* has stated the cost per 100 lb. of certain towers "delivered in the field" as $4.50, or allowing 50 cents per 100 lb. for freightage—$4 per 100 lb. f.o.b. shop. A tower weighing from 1800 lb. to 2000 lb. will have the following general characteristics: Height, 45 ft. to lowest conductor; height over all, 55 ft., approximately; base, 12 ft. x 12 ft.; pyramidal form; conductors, three main, approximately No. 1 B. & S. hard-drawn copper cable 7 ft. on centers triangularly spaced; two telephone conductors spaced parallel on approximately 2-ft. centers. One overhead grounded wire; span, from 500 ft. to 600 ft.; wind, maximum, 80 miles per hour actual; sleet, layer ½ in. or 1 in. increase in effective diameter with low wind; factor of safety under maximum wind stress, 2.

This tower is probably a very light (economical) form for the purpose. Other manufacturers to secure the same results would use more weight and consequently charge more. There might incidentally be a greater strength in the latter towers which would be more of an accidental result of the natural limitations of the structure than a matter of intention.

POLES.

Although reinforced-concrete poles have come into notice and consideration, their adoption for high-tension work is hampered by two serious factors. If molded away from the point of erection, cartage and incidental handling alone may make their adoption unduly expensive, while if molded at the point of erection the cartage of supplies, and in some cases of water also, makes their cost too great. Concrete poles can doubtless be built for very heavy work, but it is doubtful whether they will ever be feasible except for short-span requirements for local conditions.

There is, furthermore, an idea probably fixed in many men's minds that a wood-pole line for such voltages as are here discussed is always cheaper than the metal-tower line. This is erroneous to the extent that the proximity of a suitable pole supply is the determining condition; for such potentials as 100,000 volts, however, with suspension type insulators and long spans, the metal tower has obvious advantages. A comparison of cost with wood poles is really not strictly fair

*Transactions A. I. E. E., 1907, Vol. XXVI., Part II., page 1232.

since in the case of a wood-pole line no such mechanical strengths can be stipulated as in the steel towers. The latter thus have an inherent advantage that is very valuable. If, in addition to the foregoing, the depreciation of the respective elements be considered the towers will be found to have a further superiority.

SPECIAL TOWER FORMS.

Thus far only dead-end and ordinary supports have been mentioned. Note should also be made of the following:

Guying.—The application of guys to certain towers in the line to strengthen against curves or possible mechanical surging due to a break in the wires is often taken advantage of. The application and necessity of such a detail need no further discussion.

Angle Towers.—An angle in a transmission line may be turned gradually as a curve or abruptly at one point. In the former case a number of standard towers on shorter span and properly guyed, if necessary, are placed on the curve. In the latter a special tower of dead-end form may be used with proper provision thereon for the change in direction. The latter expedient may sometimes prove desirable since it will permit of longer tangents.

Sectionalizing and Cross-Over Towers.—One of the most important requirements in a long transmission line is the need of securing continuity of service. A double-circuit supply (two adjacent pole lines) is supposed to insure continuity to a great degree. It happens, however, that often only a small portion of one of the lines may be affected, and if some means could be employed for running the remainder of both circuits in multiple, a more satisfactory regulation of the line under such circumstances would be feasible. To this end a transmission line can be subdivided into certain unit lengths as conditions may indicate to be desirable, provision being made at the junction points for cross-connection from one line to another by suitable air-break switches. In this way one can conceive of only a small part of one circuit of a 70-mile line being out of commission, the remainder being tied in multiple through the corresponding good link of equal length. It is clear that by proper methods of operation an interruption to a line could be made very short; in fact, only as long as might be required for the tracing out of the successive sections. The towers for this purpose are, of course, more elaborate than the regular line towers, being perhaps equal to four such towers.

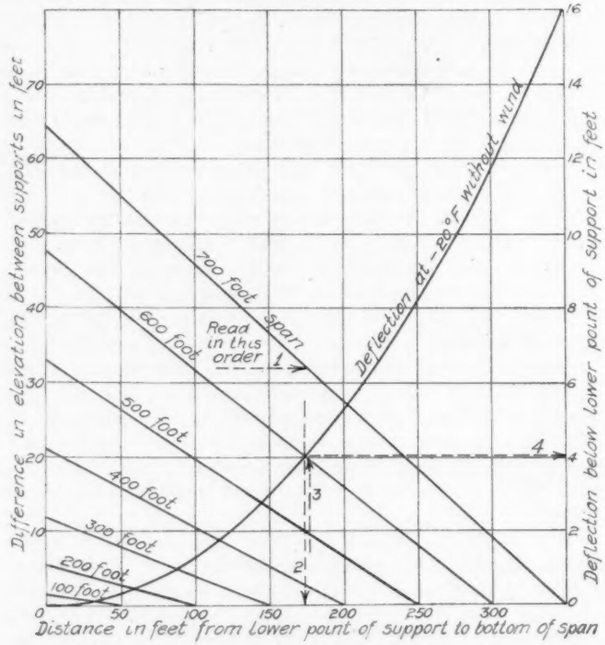
Fortunately, the presence of a substation at such a sectionalizing point enables a tap to be made very conveniently for local supply. By a proper arrangement of knife switches, all of which can be mounted on the tower, a means of quickly clearing the line is supplied.

River Crossing.—Certain rivers are considered by the United States War Department as navigable for only a part of their length and up to this point the consent and approval of the department must be obtained before the transmission line can cross. The critical point, however, is the clearance above the river level and once this is fixed the size of the necessary towers to secure this clearance is easily determined. The towers for this purpose are likely to be very high—at least 100 ft.—and therefore require consideration more as self-supporting structures than as a part of the line, since they are essentially of the dead-end form. This statement, of course, needs modification when applied in special cases, like the Straits of Carquinez, in California, but the principle holds good, nevertheless, particularly for the usual inland crossing encountered by the majority of transmission lines.

Foreign Wire Crossings.—So thoroughly ramified throughout our country are the telephone and telegraph lines that it is scarcely possible for a long-distance transmission line to escape crossing them many times. For this condition no standard practice has evolved itself to date; the nearest approach to anything like a standard form of crossing is embodied, first, in the well-known cradle protection, which is a grounded screen hung between the two circuits requiring insulation; and, second, in the principle of such comparatively short spans with towers of appropriate height as to preclude the contact of the high-tension wire and the telephone circuit in the event of failure to the former.

It is clear that either of these methods in the case of long-span work may become very expensive, perhaps financially impossible, and resort must be had to other means. In general, the transmission-line company is in possession of full information as to the various telephone and other foreign wire circuits which it will cross just as soon as the right-of-way has been settled on. It is obviously in the best interest of all concerned that the transmission company confer with the various interests and obtain suitable and reasonable agreements as to the protection required. In some cases the screen may be feasible, in others special spans may be necessary.

Profile.—Where the standard spans are only 100 ft. or so the adjustment to changes in profile can easily be made. The late Dr. Perrine indicated a method whereby poles of differing lengths can be utilized to produce a span many times the width of the standard span, but still of identical inherent characteristics. This method, of course, is not so desirable with standard spans of the magnitude of 700 ft., and here provision must be made for making each span throughout a complete one in itself. The accompanying curve shows the respective differences in elevation possible with a span of 700 ft. as covered in this problem. From this curve it will be evident that in order to secure a satisfactory line a profile of the right-of-way must



CURVE OF DEFLECTION OF MAIN CONDUCTOR WITH SUPPORTS AT DIFFERENT LEVELS.

first be made and the towers must be placed step by step in order to determine their exact location.

Where there is a double right-of-way the profile data should cover the center line of each row of towers, particularly since the hilly part of the line may be on badly sloping side hills where excavation is undesirable or even impossible.

It is obvious from the above that a modern high-voltage line must be carefully located in advance, and any departure from these points may seriously affect the feature of uniform mechanical tension which is by this means maintained throughout the line.

A study of the profile will, therefore, result in discovering the required quantity of towers of special height; for it must be stated that while it is possible to have a number of variations of differences of level of supports for a given span, it is likewise possible to have a greater span of the same inherent tension which may still enable the standard towers to be used although considerable differences of elevation are to be encountered. In addition, by drawing in the span curves for respective spans where there are differences of elevations or a wide departure from level or uniformly sloping ground, an exact adjustment to conditions can be made. In doing so the

variations of length between extreme hot and cold conditions should be borne in mind—the minimum temperature condition, by reason of causing the shortest span length, likewise determines the minimum distance between the lower point of support and the bottom of the sag to which it is safe to go, whereas the maximum temperature and sleet conditions govern the minimum clearance allowable between the line and the ground. In straight-runaway work over comparatively level country the latter condition is the only one requiring consideration.

Electric Lift Magnets.

BY LAWRENCE WHITTREDGE CADY.

ALTHOUGH the electric lift magnet is by no means a recent discovery, there are many uses discovered for it every day. In fact, it is revolutionizing the method of handling masses of iron and steel, such as pigs, crop ends, blooms, forgings, scrap, and other forms of iron which have formerly required much handling by human labor. At first, electrical apparatus was looked at askance by people who had charge of heavy machinery and cheap help. Thanks to the new style of "fool-proof" motors, this prejudice is being removed and these people are eagerly adopting any electrical device that will save them time and money.

The electric magnet when used as a conveyor met with scant approval even among electrical engineers until recently. They had always known about magnets and this new application seemed amateurish and impractical. Therefore, contrary to precedent, it was developed and advocated by practical people who wanted results, and had more faith than electrical theory. The electrical profession has at last awakened and much careful study has been focused on this problem, with the result of placing on the market some very efficient apparatus.

A lift magnet is a much finer engineering conception than is commonly considered. There is probably no kind of electrical apparatus which has to stand so much abuse and yet continue to work with unvarying accuracy. It is used in all kinds of weather and under varying conditions of heat and cold; to lift material from wet places where the magnet is partly immersed in water, and to transport red-hot forgings.

As it is required to displace cheap labor it is often operated by the same kind. Therefore, it is frequently dropped on steel scrap and cast iron from a height of many feet and treated more like a "skull cracker" than a machine. The magnet must not only be very strong, but it must have great lifting power as compared to its weight. Then the lifting power must be obtained with a comparatively small expenditure of electricity. This latter condition is required not only for economy of operation, but to maintain constant lifting power. One can see that a large I^2R loss would cause heating and thus lower the ampere-turns, which in turn would cause the magnet to lift less material per load at the end of the day's run than at the start. Although there are many shapes of lift magnets, the round shallow type is being recognized as the one to be preferred in most cases.

This style of magnet is provided with ribs and flanges which help dissipate the heat absorbed from contact with hot material. The bottom plates of these magnets are made from a very hard non-magnetic steel alloy which protects them from the abrasion due to the pounding of the material lifted. Although several magnets have been designed to operate with alternating current, thus far direct current has been almost exclusively used.

Lifting magnets are mostly used either on cranes traveling on runways, or on locomotive cranes. These latter have the advantage of a wide scope of action. The locomotive cranes are self-contained, as they are equipped with a small direct-connected engine and generator, the engine being supplied with steam from the boiler which feeds the crane engines. These outfits are being extensively used by scrap-iron dealers, ship yards, railroad supply and repair yards, boiler works, iron and steel mills, and iron foundries.

Magnets operated by traveling cranes are used for many kinds of purposes. Their ability to handle red-hot forgings makes them valuable in forge shops and other places where the material to be conveyed is very hot. They are valuable conveyors in foundries and machine shops, where it is necessary to handle large quantities of small castings very quickly and cheaply without breakage. In fact, the secure manner in which a magnet will handle castings, varying in weight from a few pounds to 20 to 30 tons, is one of its chief characteristics. After a magnet once lifts its load free, nothing will ever cause it to drop except an interruption of its supply of electricity.

The amount of material lifted per trip by a magnet depends on its chemical composition, shape and arrangement. Material having the highest permeability is the easiest lifted. Certain steel alloys are so nearly non-magnetic that they cannot be thus lifted. In regard to shape, it is obvious that the more completely the magnetic field is occupied by the load, the greater will the capacity of the magnet be utilized. This explains why a magnet will lift heavy forgings, or castings such as "skull-crackers," which weigh several tons, and yet be able to lift only a few hundred pounds of turnings or other loose scrap. Much depends on arrangement to secure maximum loads. A skillful operator will take pains to place the magnet where it will get the most material per lift. He shows the same care in unloading, and when handling steel plates can unload them one at a time from a lift of five or six. In this way they can be distributed. This is done by a rapid manipulation of the switch, which thus takes advantage of the magnetic "lag" of the plates. As one would naturally suppose, hard steel possesses this property to the greatest extent. The writer has seen very hard steel billets weighing several tons cling to a magnet for three or four seconds after the electric circuit was broken.

Lift magnets, being highly inductive, are provided with different devices to overcome the destructive effect on the winding caused by the high voltage generated when the circuit is broken. The windings of some makes of magnets are protected by having a resistance shunted across the terminals just before the circuit is broken. One make uses a carbon controller switch for this purpose which has a non-inductive resistance and is arranged to reduce gradually the current and voltage to a low value before the circuit is broken.

Care should be taken to have separate service wires for the magnet circuits, as every precaution should be taken to guard them against chance interruption. The blowing of a fuse or opening of a circuit-breaker may result in damage of property or perhaps loss of life. When possible, magnets should be arranged to have their own right of way. There has been a much less number of cases where magnets have dropped their load prematurely than of loads falling from the breaking of chains, ropes, or insecure tying, while their ability to automatically load and unload makes it unnecessary for the presence of human labor in their vicinity. Companies handling large quantities of iron and steel have found that a locomotive crane equipped with a magnet will do work which formerly required 20 or 30 men.

Magnets are used by divers to assist them in recovering material from wrecks. They have long been used in removing loose pieces of iron from other metals. In fact, magnets are destined to take an important part in the future handling of iron in its various forms, from rough sand cast pigs to highly finished machinery.

Repairing High-Voltage Lines While in Service.

BY J. S. JENKS AND W. H. ACKER.

REALIZING the necessity of reducing line interruptions to a minimum, some years ago the writers made experiments on the high-voltage lines of the West Penn Railways Company and found that work could be safely accomplished on 25,000-volt lines while the latter were in service by grounding the line wire on which the work was to be done. Insulators and tie wires could be replaced; but work could only be done on one wire at a time. Means have been devised since then for working on ungrounded lines in service and the facts are embodied in the present article.

Material and tools for doing repair work are placed at many

points over the system where they will be most accessible. A wooden case with glass front containing tools, etc., for use in case of emergency is permanently mounted on the wall in the power station, each substation and office. This case contains climbers, safety belt, connectors, come-a-long, test set, etc., an acetylene gas lamp with a supply of carbide, a combination saw and hammer, emergency pole, insulator, screw clamp, hand screw and Narragansett emergency outfit. The climbers, safety belt, connectors and come-a-long are standard tools as ordinarily used by linemen. The small telephone test set was designed and built by the company and weighs about 3 lb. and 13 oz. This set is so designed that the drops in the stations are released by battery rather than magneto current. The acetylene gas lamp is a Solar bicycle lamp with special bale handle so that it can be carried more readily. The combination saw and hammer consists of a machinist's hammer with a saw blade attached by bolts to the end of the hammer-handle, thus forming an insulated handle for the saw. The emergency pole is of wood about 2 in. in diameter and 10 ft. long, threaded at one end for an emergency insulator of porcelain, designed to protect the emergency pole and under petticoat of the insulator from a driving rain, even though it might have to be put up at a considerable angle from the vertical. These insulators are fitted with a wire clamp for attaching the line wire to the insulator. The screw clamp is made of iron, having a ring at one end, which can be turned at any angle and which is just large enough to allow the emergency pole to go through nicely. The hand screw has a very sharp-pointed thread and lever handle so that it can be screwed into the main pole very easily. The Narragansett outfit contains a hypodermic syringe and tablets, distilled water, brandy, and instructions for use in resuscitating persons who have received an accidental shock.

From time to time additions have been made to these emergency cases in the shape of oil lanterns, a supply of carbon oil, a small rope and set of blocks.

About the same time repair arms fitted with pins and insulators were put up on the lines at intervals of about ¼ to ½ mile. These arms were attached to poles two or three sections back from each road crossing, the idea being to place repair material at points along the line and at the same time to hide them from malicious persons passing along the highway. Along the private telephone line at various intervals test stations are cut in so that linemen when out hunting transmission or telephone troubles can open the telephone line at these test stations and ascertain by listening the direction in which trouble is located.

With this equipment temporary repairs were made to the lines while they were in service, the temporary work being left on the line until several such repairs had been made when an interruption would be arranged for at some time when least objectionable to the customers, and all temporary work removed and permanent repairs made. This enabled interruptions to be forestalled and gave almost absolute control of the time at which such interrutions would occur and their duration. The work consisted principally in removing damaged insulators from the line, the greater portion of the trouble being due to broken insulators. When such a case of trouble is found by a patrolman it is reported by telephone and men are sent out immediately to clear it up. Very often trouble occurs on double-arm poles, in which case, provided only one insulator is defective, the pin supporting defective insulator is sawed off at two points, between the bottom of the insulator and top of the cross-arm, leaving an air-gap of about 3 in. between the pin and the cross-arm, or the pin is sawed off and the top of the pin screwed out of the insulator by canting it to one side. In cases where the defective insulator is on a single arm some support for the line wire must be provided before the pin can be sawed off. This is accomplished by using an emergency pole, a screw clamp and an emergency insulator. The screw clamp with ring is first fastened securely to the cross-arm just under the defective insulator, the emergency pole is then run through the ring on the clamp and the emergency insulator is threaded on the emergency pole, the pole and insulator being pushed up until the wire clamp on the insulator engages the line. The pin is then sawed off and the line slightly raised by means of the emergency pole until it clears the stub of the pin. The bottom end of the emergency pole is then made fast to the main pole or a lower cross-arm by means of the hand screw. In some cases a rope sling is used to support the top of the emergency pole from the main pole in place of the screw clamp, the bottom of the emergency pole being fastened by the hand screw. The sling cannot be used universally and is not as secure as the screw clamp with ring, as it leaves a possibility of the line wire being blown in against the structure or against another wire should the wind be blowing the right direction.

Temporary repairs have been made in this manner in cases where the trouble was due to defective insulators; also where the pins, cross-arms, braces, or all had been burned off due to broken insulators, or the line wire getting in contact with the pins or structure. About one year ago a systematic and thorough inspection of poles, cross-arms, braces, etc., was inaugurated on all old lines. This inspection revealed the fact that a considerable number of top and bottom cross-arms and braces were either rotten or defective from other causes; also that there were a number of pins on which insulators were loose, due to "digestive action" or shrinkage. In order to carry on the work of replacing the bad cross-arms, braces and pins without interrupting the service, special tools and material were necessary. These were designed and made up after some experimental work. These tools consisted of a number of the above

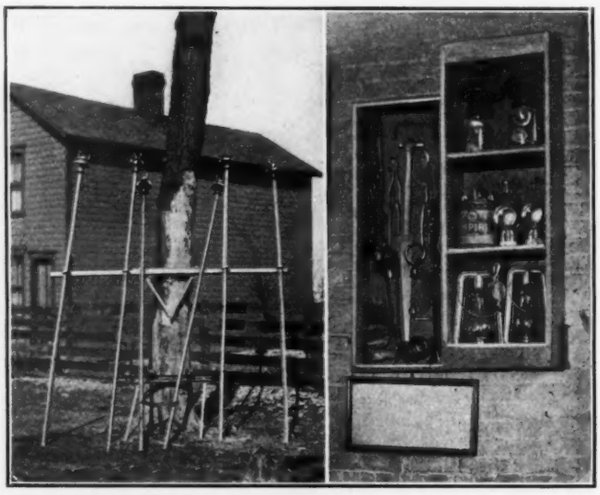


FIG. 1.—EMERGENCY EQUIPMENT.

mentioned emergency poles, some of them being extra long; a light weight reinforced hickory cross-arm with metal braces and cleat for lagging to the pole, several adjustable clamp rings for properly spacing the emergency poles, a pair of light metal cross-arms arranged to support the emergency poles at the proper height. Defective bottom arms were replaced first on account of the additional safety afforded when working on top arms, by having the bottom arms in good condition and also in order that the information and experience gained on this work would be of aid in handling the more dangerous work, as ordinary linemen had to be trained for this purpose. The men have become quite proficient at this work and have inaugurated a system of proper names for the tools with an idea of facilitating the work and preventing error.

About 350 to 400 bottom arms have been replaced without experiencing any trouble whatever, the work having been done under varying and difficult conditions. The time required to replace a two-pin arm varies from 15 to 30 minutes, the average time being about 25 minutes.

When the work of replacing defective top arms was taken up the method of handling and supporting the line wires had to be elaborated and additional tools designed. Fig. 2 gives a series of photographs showing this work in progress. The first is a view of the pole which has a defective top arm just previous to starting work on it. Next is a view of the

same pole after driving the pins out of the bottom arm, both lines having been moved to a safe distance and supported on ordinary emergency poles and insulators by the iron fixture on the main pole, and having been dropped out by means of the rope slings attached to the top of the emergency poles and fastened to the main pole. The third view shows the same pole after work has progressed a little further. The four top wires

The authors wish to call attention to the fact that damaged insulators have been replaced with new ones, tieing the new insulators in without cutting the current off the line, using the company's standard method of tieing in and thus permanently repairing the line while it was in service, putting the line in just as good shape and making the repair just as secure as it would be had it been made with the line dead.

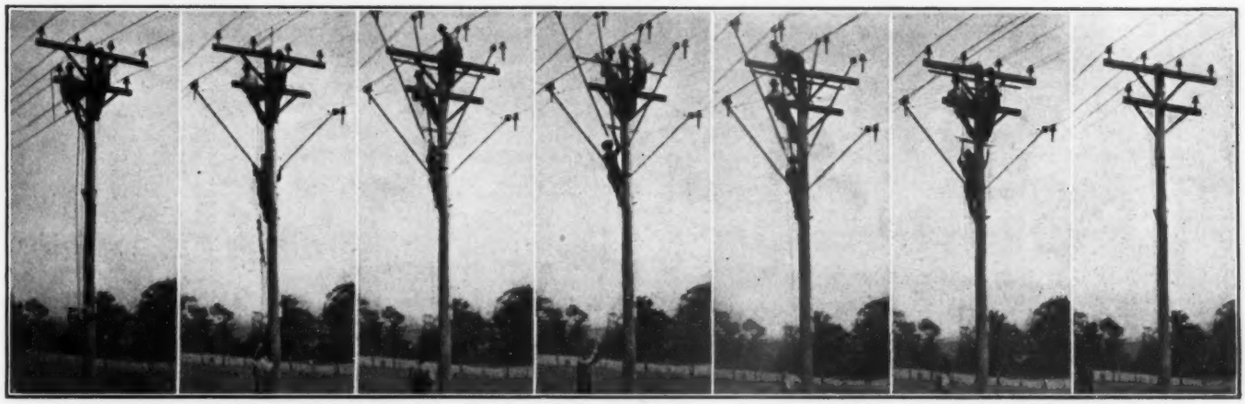


FIG. 2.—VIEWS SHOWING METHOD OF REPLACING DEFECTIVE CROSS-ARMS ON LIVE HIGH-TENSION LINES.

have been removed from the cross-arm by driving out the two pole pins and sawing off the two outside pins, which in this case were so tight that they could not be driven out, new pins having been screwed into the insulators. The wires are supported at a safe distance above the cross-arm by the emergency poles, which are held in place by the small hickory cross-arm fastened near the top of the pole and the iron fixture lower down the pole. The defective top arm being off the pole, a pulley is fastened on top of the main pole for pulling up the new cross-arm, which is shown in place and ready for the line wires to be put on. The pins are then inserted and nailed in the new top arm as shown, the old pins being used again in all cases where it is advisable. The emergency poles and attachments supporting these wires are then removed. The lower wires are now placed in their previous position on the arm and the pins are nailed, the completed job with all the supports and poles removed being shown in the last view.

In this manner the company has thus far replaced over 200 four-pin top arms; the time necessary to replace a four-pin

The most difficult portion of this repair is removing the old tie wire and tieing the line wire to the new insulator. The line wire is taken care of in the same manner as previously described. The damaged insulator is shattered with a few blows with an insulated hammer and falls to the ground, leaving the tie wire attached to the line wire. A pair of wire cutters with long insulating handles are used to cut the tie wires and to untie them. A new insulator and pin are now put in place and the line wire is put in the groove of the insulator. The new tie wire, about 30 in. long, is now bent into a U shape, one leg about 3 in. longer than the other, and the legs about 2 in. apart. Gripping the tire wire with the cutters about the center of the bend, the longer leg is laid over the top of the insulator from the pole side crossing the line wire, the other leg passing under the line wire and partially around the head of the insulator in the side groove. A perfectly dry treated wooden stick about 1¼ in. in diameter and 36 in. long, having a short ferrule at the center with a hole through the ferrule just large enough to let the tie wire enter, is slipped as far as possible

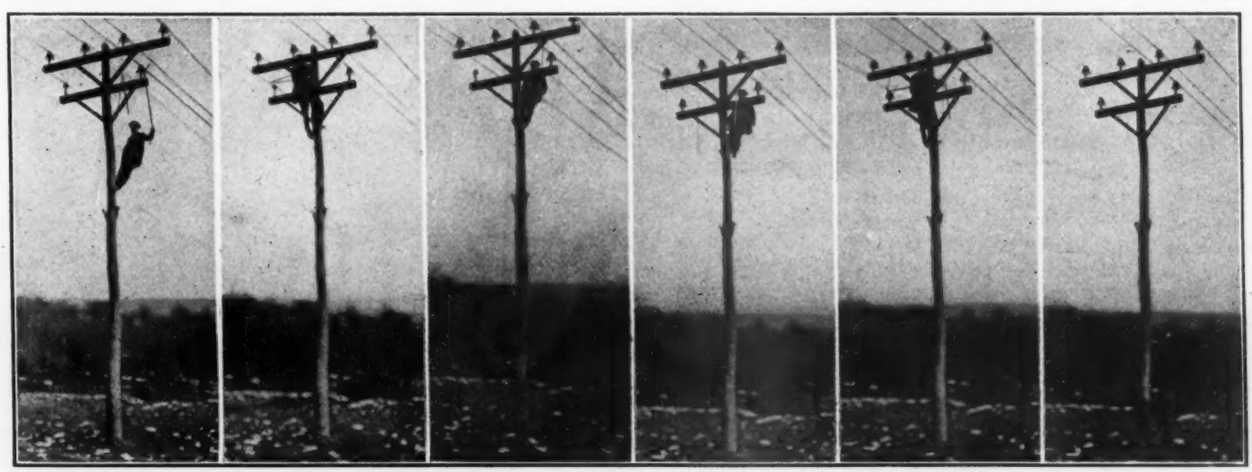


FIG. 3.—VIEWS ILLUSTRATING THE USE OF CLAMP AND TOOLS IN REPLACING INSULATORS ON LIVE HIGH-TENSION WIRES.

arm varying from 30 minutes to one hour, the average time being 50 minutes. The average cost of replacing a two-pin arm is $2, including all labor and material. The average cost of replacing a four-pin arm is about $3.50, including all labor and material. Four men are sufficient to carry on the work satisfactorily.

over the longer leg by a man on the opposite side of the insulator and then manipulated so as to pull the tie tight over the top of the insulator, then under the line wire and partially around the head of the insulator, going back on the pole side to the man who is holding the tie with the wire cutters. This man removes the wire cutters and after slipping all the slack

possible out of the tie into the shorter leg by hitting it with an insulated wooden mallet he holds the stick passed to him, while a similar stick is slipped over the shorter end of the tie which is on the outside of the insulator. The second stick is then handled so that the tie is pulled tight around the head of the insulator in the side groove, thence under and around the line wire until the tire has been pig-tailed out some six or eight turns. The long end of the tie is now pulled tight around the pole side of the insulator, slack being taken out as before, then passed under and around the line wire and pig-tailed out as was done with the other end. The sticks are then removed and the surplus tie wire at each end is clipped off close up to the line wire. This tie is very much tighter than one put on by hand with the line dead, due to the leverage of about 15 to 18 in., which is obtained by use of the sticks. When it is necessary to replace an outside insulator U-shaped sticks, such as are ordinarily used for backs of chairs, are substituted for the straight sticks, so that they can be more readily handled from one side of the insulator. On the average it takes two men about 15 minutes to replace a defective insulator with a new one and to tie in the line.

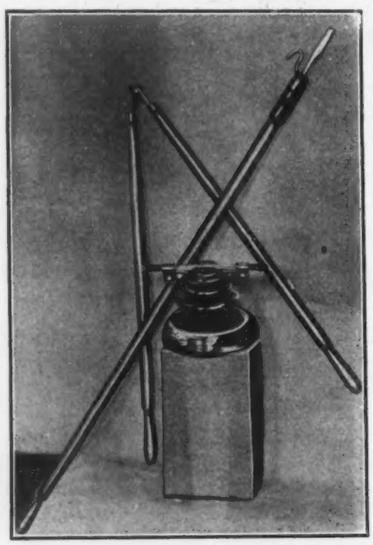


FIG. 4.—INSULATOR CLAMP, SCREWDRIVER AND WIRECUTTERS.

A safer and quicker method for making such live line repairs is to use a clamp in place of the tie wire, as a repair can be made much quicker by one man and with much more safety. A clamp has been designed which fulfills all conditions, though the details must be modified to a certain extent in order to adopt it for use with the various sizes and shapes of insulators. Special tools are necessary in connection with the use of this clamp, but these tools are very simple and inexpensive. An ordinary steel screw-driver blade and a hook provided with a long insulated handle; a pair of wire cutters, also provided with long insulating handles, previously mentioned, would be sufficient. In Fig. 4 is shown the clamp, also an insulated screwdriver with a hook and a pair of insulated wire cutters. In using the clamp for replacing an insulator the line is taken care of and the insulator and the tie wire removed, as previously described. The brass clamp is fastened to the head of a new insulator with the jaws in line with the top groove and the insulator is put in place on the pin, the jaws for clamping the line wire being loose; the wire is then placed between the jaws of the clamp and fastened securely by means of the small screws which tighten the jaws. Fig. 3 illustrates the use of the clamp and tools. The first view shows a glass insulator with bottom petticoat broken entirely off, supported on a good pin and tied in on a No. 0 copper line. The second shows a dry hand line which has been passed over the upper arm and fastened to the line wire to prevent its falling when the tie is removed, also the lineman removing the tie wire with the insulated wire cutters. The next is a view with the tie wire removed and shows the line wire pulled up by the hand line. The defective insulator is replaced with the new insulator, having clamp attached as shown, and the line is lowered into the jaws of the clamp, being guided by the insulated hook. The jaws are then tightened by the insulated screw-driver. The completed job, the wire being securely held by the clamp, is shown in the last view.

The cost of these clamps is considerably in excess of the cost of a tie wire, but this is insignificant when compared with a loss which the interruption to the service means even on lines transmitting a comparatively small amount of energy. Brass clamps are used on all copper lines, while aluminum or aluminum lined clamps are necessary for aluminum lines.

New poles have been set with the line working by simply taking care that the pole does not come in contact with the line wires, after which the cross-arms and insulators are put on as above described. Several lines have been moved without interrupting the service by simply digging trenches and moving the poles bodily.

Live high-voltage work has not been limited to the lines only, but has been carried on inside the stations. The most important repair made on inside wiring was reconnecting a lead from an air stick breaker to the busbars. This lead burned off about 4 in. from the bus at a time when an interruption was especially undesirable. The repair was made in the following manner: The air-breaker was removed, allowing the line to work by the two other wires and around the hoop; a small brass wing nut clamp resembling a hand vise was then connected to the end of the broken lead which was dead. A piece of asbestos lumber was placed so as to prevent the flame from short-circuiting the buses, while the insulation on the short piece of wire which was attached to the live bus was burned off with a blow torch fastened to the end of a good dry stick. After the insulation was burned off the wire was cleaned by a piece of sandpaper attached to the end of a stick. As the clamp would not close on the small wire attached to the bus, a tube made of gauze was used to bush up the clamp, which was then shoved on the small wire and the wing nut was set up by means of a stick with a slot in the end. This made a very good contact and the stick-breaker was replaced, re-establishing service over this wire. The connection has been working perfectly ever since. In a somewhat similar manner taps have frequently been made to the transmission lines in order to supply electricity at some point where the company had not previously possessed a substation.

No definite figures can be given on the value of this work, but the cost of maintaining the transmission lines has been greatly reduced, as all repair work has been done in the daytime, and much quicker than it could be done at night. The items of livery hire and extra time have been practically eliminated. A large amount of revenue which would have been lost during the time the line was off is also saved, as the territory which would have been without electricity in case interruptions had been necessary is very large as at the time this work was done the West Penn system was not looped. A large but indeterminate amount has been added to the selling value of the output, due to increased reliability of service, which has an average time efficiency of 99.96 per cent.

The safety of men engaged on this work should in all cases be given first consideration, and all tools, apparatus, etc., to be used in making live line repairs should have a large factor of safety, both as regards insulating qualities and mechanical strength. In the above the authors have attempted to outline what has been accomplished in the way of live repairs on the West Penn transmission system, where there are wooden supporting structures throughout, and have touched on almost every phase of live high-voltage repair work except the splicing of the live wire. Provided the supporting structure and insulation of a line are kept in first-class condition, the liability of interruptions due to the line breaking or burning off will be greatly reduced, as such trouble in most cases is the result of a failure of some other part of the construction.

Titanium-Carbide Arc Lamp.

Mr. C. R. McKay, formerly of the Toledo Railways & Light Company, and now of the Union Light, Heat & Power Company, Covington, Ky., communicated a report on the titanium-carbide arc lamp at the Ohio Electric Light Association convention on July 15. He called attention to the rapid advance made in arc lighting in the past 10 years. The magnetite or metallic oxide flame lamp now produced by two of the leading electrical manufacturing companies uses a solid metal positive electrode, generally of copper, and a negative composed chiefly of powdered magnetic oxide of iron with oxides of titanium and chromium in small quantities, the mixture being contained in a thin soft iron tube. In this mixture each oxide appears to perform a distinct function, the iron furnishing the required conductivity, the chromium the essential life and the titanium the majority of the brilliant light of the arc. Both types of this lamp owe their illuminating superiority chiefly to the titanium contained in the negative electrode. They operate with direct current and necessitate some rectifying apparatus when only alternating current is available.

There has recently been developed a system of arc lighting with alternating current in which use is made of lamps with

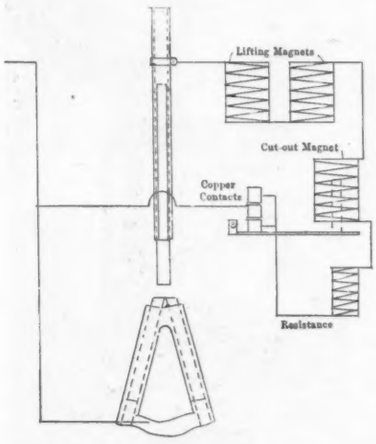


FIG. 1.—CONNECTIONS FOR SERIES LUMINOUS ARC LAMP.

electrodes composed largely of titanium carbide, thereby avoiding current rectification and obtaining increased lighting efficiency.

Experimental circuits of such lamps have been maintained for considerable periods by both the Westinghouse and the General Electric company, and while neither company has thus far commercially standardized, or placed such a system on the general market, several important equipments are in commercial service with a view to demonstrating their possibilities.

Their characteristics are as follows:

The luminous efficiency is high, the specific consumption approaching 0.33 watt per mean horizontal candle-power. Value is about 25 per cent less than that of the 4-amp magnetite arc. The cost of electrode materials at present is high (about 20 cents per trim), and constitutes the principal item in the operating cost of the system. The light possesses a yellow tinge, which is objectionable. The arc is unsteady and the slag condensed from the vapor of the arc may occasion difficulty by fusing into the globe. It is difficult to secure a power factor higher than 55 per cent from the system, because of the reactance required in the circuit to steady the arc. There are in operation three installations of titanium-carbide lamps, respectively, at Rochester, N. Y., 150 lamps; Schenectady, N. Y., 100 lamps, and Haverhill, Mass., 250 lamps.

The system as now operated consists of a plain series lamp without shunt winding, an oil switch in series in the circuit, automatically opened and closed by a clock control relay at suitable feeding intervals, and finally a constant-current transformer. Fig. 1 is a diagram of the lamp connections and arrangements.

The lamp mechanism consists of two series magnets which, through clutch, raise the upper electrode to the proper arc length, where it is held, while the arc burns until the station relay momentarily opens the oil switch, interrupting the current through the entire series circuit, and allowing the upper elec-

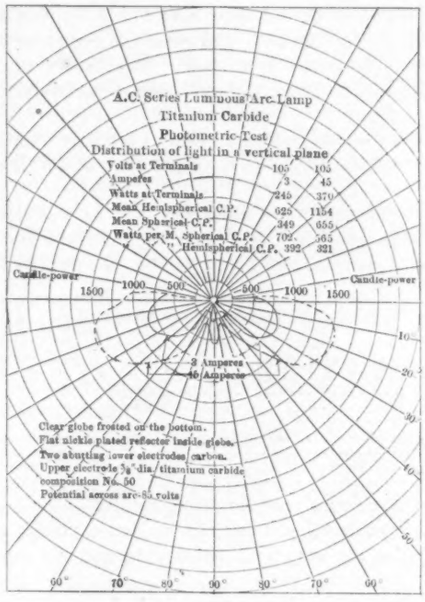


FIG. 2.—CURVE OF CANDLE-POWER DISTRIBUTION.

trodes to drop; the oil switch then closes, immediately completing the circuit to the lamps and again drawing the arcs.

The lamp has three electrodes, the upper being a round stick composed chiefly of titanium carbide, approximately 12 in. long and 0.4 in. in diameter. Each of the two lower carbon electrodes is 6 in. long and 0.4 in. in diameter, of half round section, and held in an inverted "V" position so that their upper tips abut, thereby presenting a circular flat surface toward the upper electrode. The upper tips of the lower electrodes are maintained in contact by a metal finger pressing upward beneath the electrodes as the latter burn away. This lamp arrangement preserves a focusing arc without the complication of a feeding mechanism therein.

The insulation of the lamp is protected against excess potential by shunting the lamp with a suitable spark-gap in series with a resistance and a cut-out magnet, which short circuits the gap. Thus, when the potential across the lamp exceeds the breakdown point of the spark-gap, electricity flows across the gap through the resistance and the cut-out magnet, whose core, linked to one terminal of the gap, rises, thereby short circuiting

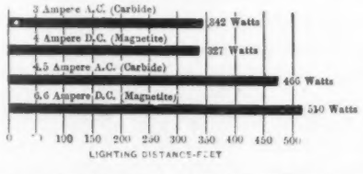


FIG. 3.—COMPARATIVE LUMINOMETER DISTANCES.

the gap through the resistance and dropping the potential across the lamp terminals.

With this type of lamp, as with all the metallic vapor arcs, the fumes and condensed vapor must be carried away by suitable ventilating arrangements. A single clear globe with a perforated base is used with the existing style of lamp.

The existing systems operate at 2.5 amp, but there are in production lamps of 3 amp and 4.5 amp respectively.

The characteristics of these lamps are as follows:

Amperes	3	4.5
Volts at terminals	105	105
Power factor	78-80	78-80
Watts	245	370
Mean horizontal candle-power	624	1154
Watts per mean horizontal candle-power	0.392	0.321
Mean spherical candle-power	349	655
Watts per mean spherical candle-power	0.702	0.565

Polar candle-power distribution curves of these lamps are shown in Fig. 2.

The electrode life of the upper and lower sets approximates 75 and 50 hours for the two sizes of lamps respectively.

The relative luminometer distances for the several sizes of magnetite, and the titanium-carbide lamps respectively are shown in Fig. 3.

The efficiency of the system is given as from 95 to 97 per cent, and the power factor from 50 to 60 per cent, at full load, on 60 cycles.

The following figures on operating cost of the alternating-current, titanium-carbide lamp as compared with the direct-current magnetite lamp are given by the manufacturer:

	3 amp. a.c. Lum.	4 amp. d.c. Lum. Rectifier.	4.5 amp. a.c. Lum.	6.6amp. d.c. Lum. Rectifier.
Energy at switchboard at 1 ct. per kw-hour.	$11.28	$14.08	$17.00	$21.48
Electrodes	10.80	1.70	16.00	3.75
Trimming	2.40	1.00	3.50	2.30
Repairs	.75	.50	.75	.60
Globes	.50	.50	.50	.50
Rectifier tubes		2.00		3.00
Total	$25.73	$19.78	$37.75	$31.63

The constant-current transformer is similar in all respects to the familiar type developed for the series-alternating enclosed arc system, the 100-lamp unit being arranged for two series circuits.

The oil switch, which instantaneously and periodically breaks the lamp circuit, thereby performing the function ordinarily performed by individual lamp feeding mechanism, is operated by a 110-volt alternating relay circuit, opened and closed at proper intervals by a time clock. The relay device embodies an induction motor element actuating a contact finger corresponding to each relay circuit, there being one such relay circuit and oil switch for every separate equipment installed.

The titanium-carbide system has not been developed with the intent or expectation of displacing the magnetite or metallic flame systems, but rather to supplement them, and in some cases to afford the advantages due to the use of alternating current in the arc lamp circuits. The author expressed the opinion that until it shall be commercially practicable to produce satisfactory arc lighting from unrectified alternating current at 25 cycles, the magnetite systems will remain the preferable and most efficient means of arc lighting from low-frequency supply, while much remains to be accomplished toward reduced operating and maintenance expense before the titanium-carbide system will, even at higher frequencies, prove its superiority.

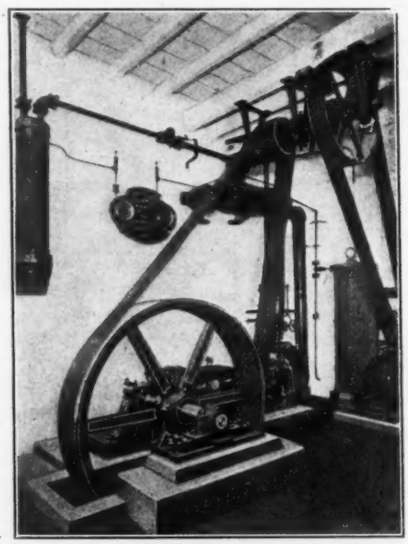
Electrical Refrigeration for Butcher Shops.

By R. L. Lloyd.

Of the trades requiring artificial refrigeration, one of the first to become interested in the subject was that large and widely dispersed class handling meat. Including the small retailers of this perishable food supply, their number is legion and the comparatively high cost of installation is the only bar to the universal adoption by them of the refrigerating machine. For the purpose of this article a moderately large installation for a shop in which the butcher doing his own slaughtering and retailing may be cited. The accompanying illustration shows the machine and motor. The machine is a 7-in. x 14-in. Heutteman & Cramer compressor, with a 72-in. flywheel, running at 72 r.p.m. Under this speed the machine develops about seven tons of refrigeration. At a higher speed it is capable of eight tons. The motor is a 15-hp Westinghouse machine.

Two boxes are cooled by direct expansion. Both have brine tanks for storage and auxiliary cooling. In the store where the cuts are kept for retailing, the box is 10 ft. x 10 ft. x 8 ft. high, and the brine tank 20 in. x 24 in. and 9 ft. 6 in. long, containing about 200 gal. of brine which is maintained at a temperature of nearly 40 deg. The refrigerating pipes are controlled by an individual valve which allows a wide range of regulation; but too low a temperature is not desired. Fruit and vegetables are also stored in the refrigerator.

A larger box in the rear, near the slaughter house, is 10 ft. x 11 ft. x 20 ft. The high ceiling is necessary to keep the hanging beeves clear of the floor. There are two brine tanks here ranged one above the other on one side. They are each 18 in. x 24 in. x 11 ft. and hold 205 gal. of brine. The temperature in the box is maintained at from 30 deg. to 32 deg., which is sufficient to keep the meat in prime condition. There are usually 8 or 10 beeves and 10 or 12 mutton hanging. Killing is done two or three times a week, depending on the season and the meat supply. Seven or eight cattle and 20 sheep or lambs is the average weekly work. If an opportunity is offered to make a profitable purchase of cattle it is a very easy matter to get the whole lot quickly hung up in cold storage. Under former conditions this was not feasible and the cattle had to be kept on the hoof and fed; a method which inevitably resulted in a



EIGHT-TON REFRIGERATING MACHINE.

shrinkage of weight. To maintain the above-mentioned temperature the refrigerating machine is operated only a small portion of the day, as shown by the following record:

May	70 hours	July	111 hours	September	96 hours
June	80 "	August	118 "	October	85 "

The kw-hours consumed during these six months totaled 7251, while for the other six months of the year only 2058 kw-hours were used. The consumption during February was one-tenth that during August. City water is used for condensing and this helps to account for this wide difference in the two months.

Besides the greatly improved hygienic conditions and better keeping of his product, the result of this investment is decidedly advantageous. Before the installation of the refrigerating machine and larger box, the yearly expenses were as follows:

Ice	$400.00
Feed for cattle at $5 per week	260.00
Shrinkage in weight at $10 per week	520.00
Total	$1,180.00

The change represents an investment of $3,500.

Electrical energy	$518.70
Int. at 5 per cent, depreciation at 6 per cent	385.00
Ammonia and repairs	75.00
Total	$978.70

a clear gain of about $17 per month, or nearly 6 per cent more on the investment.

A smaller installation in a purely retail meat shop may also be cited. The plant consists of a "baby" Larsen-Baker com-

pressor and is operated by a 3-hp motor. The machine is set up in the basement under the meat box, which is on the floor above. This box is 9 ft. x 6 ft. x 11 ft. high, and holds at times as much as six sides of beef, four or five calves and a dozen lambs, a total of a ton and a half of meat. A direct expansion system is used with a brine tank auxiliary for storage. This tank takes the place of the ice bunker in an ordinary meat box and will hold the temperature down low during the non-operative hours of the machine. With a temperature of 34 deg. when shutting off at night, a rise of only 4 deg. will be experienced by morning. In addition to the main box, the counter cases in the store and a corned-beef tank are also cooled.

In the cold months of the year, four hours' operation of the compressor per day is sufficient. In summer it is necessary to run the refrigerating machine about nine hours, while during January and February the machine is not used at all unless an unusually hot spell occurs. When ice was used, the yearly bill was $425. The bill for electricity for the first year was $250 and for the second $207. The installation cost less than $1,000. Adding interest and depreciation charges at 11 per cent to the bill for electricity makes the total operating cost $320 per year, a saving of 24 per cent, to say nothing of the added advantages of a lower and drier temperature more constantly supplied, and an improved display counter.

Engine-Room Management.

Mr. C. R. Brosius, of the Columbus Railway & Light Company, read a paper on "Engine-Room Management" before the Ohio Electric Light Association convention at Toledo, July 14. The man in charge of the power station, he said, should have a practical knowledge of his plant, should be informed on the practical possibilities of steam appliances and machinery and be able to search intelligently after sources of loss and chances for improvement, and should be a judge of material to know what is best for his requirements. He should never become attached personally to any of the men in his employ, otherwise he is not in a position to judge the value of their ability.

The two essential factors that he should maintain are discipline and system. It is a comparatively easy matter to enforce discipline where system is properly maintained. There is more to gain in an intelligent and economical use of engines and boilers than in any immediate improvement in the machine itself.

While designers and professors are discussing 2 or 3 per cent savings the customers are buying engines so proportioned to their work and so little adapted to their requirements that many times 2 per cent are wasted continually. The way to get the most work out of a steam plant is to find first in what particular the plant is lacking and then bring that part up to the standard. Find separately the efficiency of boilers and engines. If the boilers are inefficient it may be because the rate of combustion is too high or too low for the amount of heating surface. The setting may be faulty, the fireman wasteful, or any one or more of a dozen causes. The engine may be underloaded or overloaded, badly set or leaky. Find the trouble and then go systematically to work to remedy it.

Every engineer, no matter how small his station, should have organized a testing force and have piping arranged to determine what each unit is doing. Elaborate tests are not necessary. Engine tests should be simple, showing the water rate per kw-hour with indicator cards. After the water rate is obtained and found to be high, analyzing the indicator diagrams will tell where the trouble is likely to be.

At 7 per cent CO_2 in the flue gases enough unnecessary excess air is heated to keep a duplicate of the furnace plant going, and at 5 per cent CO_2 the excess would almost keep two additional plants running.

Few concerns would think of putting as much money into any kind of business as is invested in the average power station without having a clerk or bookkeeper, or a number of them, to keep an intelligent record of all transactions. The auditing department takes care of the financial end, but that does not help the engineer keep track of operating figures. In the majority of plants to-day it is the common practice to depend largely on memory for records of the repairs made on station apparatus. The author then outlines a system of keeping track of repairs in large power stations in such a way that the chief engineer will be continuously informed as to what is going on, and records kept.

The clerical force can make money for the power station in various ways. For example, it usually costs from $105 to $125 to renew a furnace arch for a 350-hp boiler. There are fire brick of various grades, and while records are kept of when the arches are renewed, it requires time to follow up records and compare results obtained by the use of different brick. If brick could be found (and they can) which would last twice as long as a poor grade, more than half the expense for renewals of arches would be saved. The same thing applies to packing and other supplies. Every power station should have a set of rules and regulations for its employees.

Boiler-Room Economies.

Mr. N. B. Ayres read a paper on "Boiler-Room Economies" before the Ohio Electric Light Association, at Toledo, July 14, from which the following points are taken:

Of the average switchboard cost, 60 to 80 per cent is spent in the boiler-room. How many boiler plants are delivering 70 per cent of the energy supplied to them? How many are delivering even 50 per cent? How many managers know what per cent of the energy purchased in coal their boilers are delivering? How many even know how much energy they are receiving in the fuel they purchase? Steam lines are carefully covered to prevent transmission of heat through the pipe. Why, then, cover the boiler tubes with scale on one side and soot on the other and expect the same transmission?

The scale, like the poor, we have always with us, but the development in chemical and mechanical treatment has robbed it of its former terrors. The average office is safeguarded against draughts by storm windows and weather strips, with a difference of temperature of perhaps 30 deg. on the two sides of the wall, while the leakage of air through the average boiler setting is neglected, although the difference in temperature is 20 or 30 times as great. The importance of this point is illustrated by a series of tests made on the 650-hp B. & W. boiler, first with plain brick setting, and then with a 0.5-in. coating of cement over the brick. The increase in efficiency in the latter case was sufficient to justify the engineers in recommending an air-tight sheet steel casing outside the brick work.

In a word, the first step toward economies is perfect condition of apparatus, not type of apparatus, because, in the first place we already have the apparatus—have inherited it—and must make the most of it; and, in the second place, there is not a great difference in the efficiencies of the various types of boilers, furnaces and heaters now on the market and in use.

As most coal contracts are made in the early summer, this must be considered. A low-grade fuel in a plant of limited capacity might be cheap in June and prohibitive in December, because of inability to carry the load with it. A point of considerable interest in figuring on coal on a guaranteed b.t.u. basis is the difference in values between run-of-mine coal and slack, or nut and slack. In this system the guarantee is to deliver so many net b.t.u. for 1 cent, and in the majority of cases it will be found that the purchaser is paying an exorbitant price for the privilege of having his fireman break up the lumps. Economy in the boiler-room is entirely a question of the man in charge. Mr. Ayres says man rather than men because it is a question of one man. It is impossible to retain firemen who have the ability to economically operate a boiler-room. If they are bright, intelligent men they graduate to the engine-room, leaving behind the young and inexperienced and the old and unintelligent. Any plant of any size can afford one good man in the boiler-room. He should rank with or above the engineers both in ability and wages. Boilers, like engines, have efficiency

curves, although the boiler curves are very flat and the average boiler will operate at a remarkable overload without decrease in efficiency. The character of this efficiency curve should be determined and the boilers operated at the highest possible point. This information is important in determining to what overload the boilers should be operated on the peak and the point at which it becomes uneconomical to cut in another boiler. Frequently boilers can be operated at or near 200 per cent of rating for a few hours, with a remarkable gain over the cost of firing up another boiler, but the increase in maintenance may overbalance the saving in fuel.

In general, the tendency is toward high furnace temperatures, high rates of combustion and high per cent of overload, and the results indicate that this tendency is in the right direction. A fire-box temperature of 2800 deg. is not uncommon. The burning of 40 lb. of bituminous coal per square foot of grate per hour is an every-day occurrence, and boilers are operated continuously at 200 per cent of the builder's rating, developing 1 hp per 5 sq. ft. of heating surface.

Discussion.

Mr. F. L. Duncan, of New Libson, pointed out that insufficient boiler capacity may in some cases prevent the use of the cheapest fuel. For example, a certain slack with a high percentage of ash might cause the lowest coal bill, but it might be impossible to keep up steam during heavy load or it might require more labor.

Mr. J. C. Martin, of Wilmington, gave some experience with boiler feed water. At one time his company had wells in gravel the water from which caused a great deal of boiler scale. A dry year they were forced to go deeper for water and found a new water 200 ft. down that when first used in the boilers caused falling off of the scale already on them, but in time this formed a different scale. This drove them to the process of softening the water before it enters the boiler by means of lime and soda ash. The company happened to have a tank 12 ft. high x 16 ft. in diameter on hand, and used this for the settling tank after treating the water with lime and soda ash to precipitate the scale-forming solids. This system had worked very well. Mr. Martin is now putting in coal scales and water meters so as to keep a more accurate record of the water used.

Mr. D. L. Gaskill reported having had 13 years' experience with a water-softening plant at Greenville. Two tanks are employed, one supplying the boilers while the settling is taking place in the other. In six years there had only been $6.50 repairs on the boilers, except grate repairs, which showed how effectively the scale had been taken care of.

In answer to a question from a member as to the shrinkage in coal weight experienced between the mines and the plant in transit, Mr. A. A. Pointer, of Antwerp, said that he found that he had to charge off 10 cents per ton for shrinkage for short weight as an average the year around. This varies according to the season, and is as high as 25 per cent in winter with coal which has lumps which can be easily thrown off. Some members suggested that sometimes shrinkage could be saved by so routing cars from mine to plant that they do not have to stand in railroad yards a great length of time. Most of the coal stealing is done around such terminal yards. There are plenty of families around such yards which are never known to buy coal.

The Prevention and Removal of Boiler Scale—III.

By W. H. Wakeman.

UNDER the exact conditions described in the previous article no economy can be expected of a boiler compound so far as the consumption of fuel is concerned (although its removal is desirable on other accounts), and as these conditions are approached in other cases the resulting economy decreases. Under the following conditions the use of a suitable boiler compound will save much fuel. Suppose that the shell and tubes are covered with hard scale, say, from 1/16 in. to ½ in. thick, and the load is so heavy that gases escape to the stack at a temperature of 600 deg. Fahr., while the temperature of the steam is 338 deg. Practically all of the scale is removed and the removal of this obstruction allows heat to pass through the iron so rapidly that the final temperature of the products of combustion is reduced to 400 deg. Fahr. In other words, much heat that formerly went into the chimney now goes into the water, hence less coal is used. The foregoing descriptions

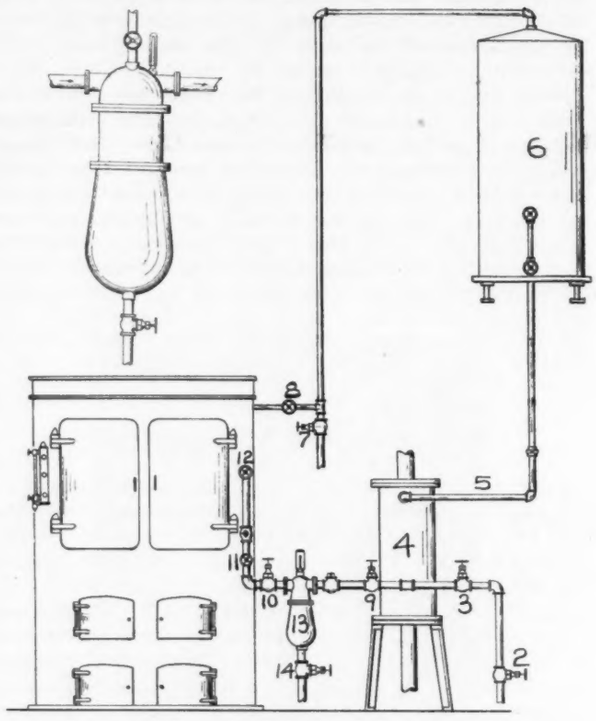


FIG. 1.—FEED-WATER PURIFIER CONNECTIONS AND DETAIL.

show why the same results are not secured in all cases from the removal of scale from boilers.

Fig. 1 represents a feed-water purifier which is used in connection with a gravity boiler feeder and an exhaust steam heater. Cold water is admitted through the valve 2 and passing through valve 3 enters the heater 4 where its temperature is raised to nearly the boiling point, provided the heater is large enough to heat it as fast as it flows through the coils or tubes against a light pressure. The exhaust steam from an engine will heat more than five times the weight of water required to make live steam for the engine, but it is possible to force cold water into some of the heaters in use faster than this admits, therefore it is not very hot when it comes out.

Passing through the pipe 5 the water enters the tank 6 and is allowed to flow in until the tank is full. During this time air is expelled through the upper pipe shown and the valve 7, which is left open for this purpose. As the tank is full of hot water the supply is shut off at valve 2, then valve 7 is closed and valve 8 opened to admit live steam to the surface of this water in order to equalize the pressure in all parts of the tank 6. When this is accomplished the valves 9, 10, 11 and 12 are opened and water gravitates from the tank 6 through valve 5 and heater 4, where it is reheated, passing thence into the boiler. A glass water gage is located near the bottom of tank 6 and when this indicates that nearly all of the water has run out the process is repeated, but it is not necessary to close valves 11 and 12 unless the check valve between them requires attention. Boiler compound is not used in connection with this device, but the water flows through the purifier 13, which retains a large proportion of the scale-forming impurities, whence they can be blown out through valve 14 to the sewer.

An enlarged view of this purifier is presented in the upper corner of the engraving which carries a thermometer at the top to show the temperature of the feed water. It is necessary for

the temperature to be kept high in order to precipitate the impurities that will not settle at a low temperature, or, in other words, below the boiling point. Carbonate of lime can be thrown down by this treatment, as the heat of exhaust steam is sufficient for the purpose. However, a higher temperature is required to precipitate sulphate of lime, which forms a troublesome and dangerous scale. If steam is carried at 100 lb. pressure or more, and the feed water is allowed to remain in the tank shown in Fig. 1 long enough to become as hot as the steam which goes into the top, much of this objectionable ingredient can be disposed of. If this is not sufficient, a higher temperature can be secured by utilizing the heat in the gases after they have left the boiler and before they pass through the chimney. As this foreign matter is precipitated and caught in the purifier it becomes necessary to blow it out several times each day, in order to prevent a large quantity from collecting at this point and being carried through the purifier into the boiler.

When feed water is analyzed great importance is attached to the amount of solid matter found in it per gallon, because some of this solid matter is objectionable. For instance, a certain sample of water contains 50 grains of carbonate of soda per gallon. This can easily be disposed of by frequently changing the water and by blowing down the boiler while it is in use, say, once in 10 hours. On the other hand, the presence of an equal weight of salts of lime would render the water unfit for use unless special precautions were taken to purify it.

In some plants it is practicable to use either of two kinds of water, one of which leaves scale in the boilers, while the other does not. For illustration, a certain plant was supplied with water from the street service, and there was a large cistern into which rain water from the shop roofs collected. The former contained more or less objectionable matter, but the latter was pure, except for a small amount of dirt. As the local company supplied this plant on a flat-rate basis, there was no special object in saving the water thus secured, but the engineer used

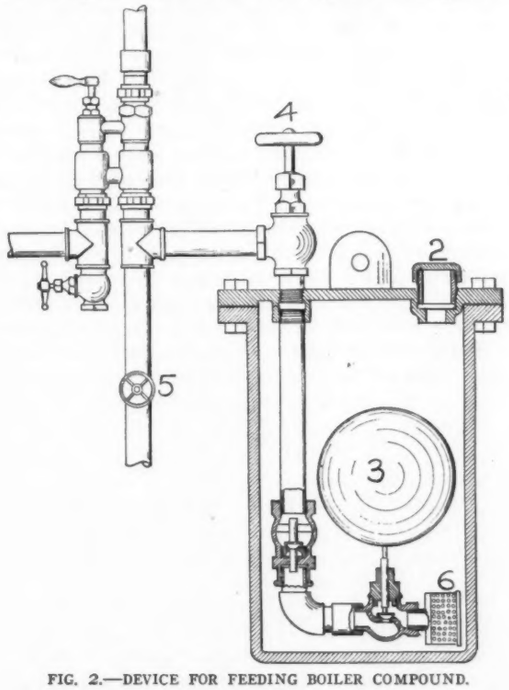


FIG. 2.—DEVICE FOR FEEDING BOILER COMPOUND.

water from the cistern at regular intervals, because he believed that it assisted in dislodging the old scale and did not form new scale to be removed by other means.

From extended observation it is but natural to infer that impurities in the feed water will pass out with the steam. The fact that more is not found in boilers demonstrates that some portion does go through the steam pipe, especially if more or less moisture goes into the engine and pump cylinders.

Fig. 2 illustrates an ingenious device for supplying crude petroleum, soda ash dissolved in hot water, or any other boiler compound, at intervals. The body is filled with the liquid through the plug 2, which causes the float 3 to rise and open the valve below it. Assuming that the inspirator is not working, the angle valve 4 must be closed, because the first water drawn by an inspirator (or any other form of injector) goes to waste. After the inspirator has been started and water comes through

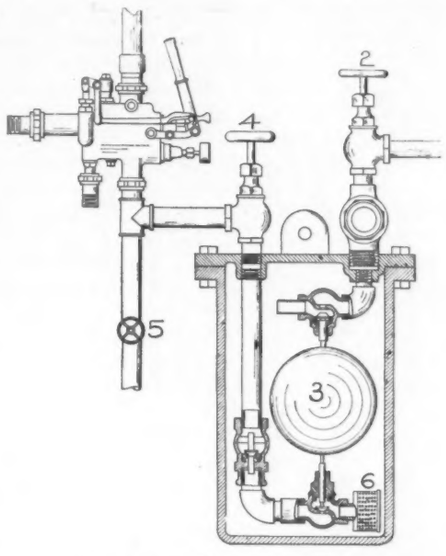


FIG. 3.—BOILER COMPOUND FEEDER.

the suction valve 5, valve 4 should be opened slowly. If the supply of water is lower than the compound feeder, the scale resolvent will be drawn in rapidly, therefore, valve 4 should be nearly closed, because, as a general rule, boiler compounds will not condense steam as fast as water, hence the inspirator will "break" and cease feeding if given too large a dose. Where water comes to valve 5 under pressure it is necessary to close it slowly until a part of the supply is drawn through valve 4. Water cannot be forced back into the compound feeder because there is a vertical check valve in the suction pipe. When about three-quarters of the compound has been drawn out the float 3 falls and the valve below it is closed, thus preventing air from entering through the strainer. When the required quantity of compound has been put into the feeder and enough drawn out to close the valve below 3, several gallons of water ought to be passed through the feeder until all of the compound is taken out. The reason for this is that the capacity of this feeder is 1 gal., and there are many cases where this quantity is considered sufficient for one boiler, but if precaution is not taken to remove all of it, the boiler will receive only 75 per cent of what was intended to go into it.

Fig. 3 illustrates a device similar to the preceding one, but designed for feeding a compound continuously, without interfering with the operation of the injector. Instead of the plug an angle valve 2 is used to admit the compound from an elevated tank, and it passes through a sight feed below the valve. When sufficient compound has run into the feeder to raise the float 3 it closes the inverted valve above it, and thus shuts off the supply. At the same time the lower valve is opened and the compound is drawn through valve 4 into the injector and thence goes into the boiler. The valve 5 in the main suction pipe is not used on a high or medium lift, but if water comes under pressure, valve 5 must be used to throttle the supply. As soon as enough of the compound has been drawn out to lower float 3 the valve above it is opened and more is admitted from the tank. It is thus possible to maintain a nearly constant quantity of compound in the feeder until it is all drawn out of the tank, when the suction valve is closed by the action of float 3, and air cannot be drawn in through strainer 6. In both cases the internal devices are fastened to the cover, hence when that is removed they all come out with it, thus making it possible to adjust or renew any part with little trouble.

The Relations Between Central Stations and the Electric Automobile

SCOPE OF INVESTIGATION.

WITH the object of determining as nearly and closely as possible the present relations between the central stations and the electric automobile as a consumer of electrical energy, the *Electrical World* sent out last May a circular of inquiry to some 4000 stations in this country, with a stamped envelope for reply, addressed to the editors. The object was to stimulate interest in the subject, hitherto neglected by many managers, and to elicit information as to the extent to which effort had been made to secure and develop this new "load." The request was made that all central-station managers receiving the form of census would reply to as many of the questions as possible and offer such comment as the situation might seem to demand. The "returns" are still straggling in, but as enough have already been received to furnish data of great value and usefulness, it has been decided by the editors to collate and digest those in hand, with the idea that others received later from impc ant places can be treated separately, if they contain new data of any significance. As a matter of fact, very nearly 1500 returns have come in from stations which represent the great bulk of the industry as to capital invested and output of current, and this fact alone stamps the inquiry as a great success, worthy of the time, expense and effort devoted to it.

As would be expected by those who know the condition of affairs, a great many of the stations have done nothing at all in this new field and have given it little, if any, attention. A common and characteristic form of response is that of writing across the schedule, "Nothing doing," without any attempt to explain the reasons or justify the absence of electric automobiles from the given territory. In many instances these are from districts where one would suppose that the electric vehicle had a good fighting chance, but, of course, if those who should be its best friends treat it with absolute indifference or ride around in gasolines it will be some time before it can come into its own, as it has begun to do elsewhere. An inquiry of this kind simply shows the tremendous inertia that has to be overcome before any great advance or improvement can take place. Before taking up the actual work done, or exhibiting the real active interest shown in the subject, it will be worth while to canvass briefly some of the remarks made on the negative side. They are not all evidences of apathy, and some of them bring out sharply the points of weakness in the electric automobile of to-day.

REASONS AGAINST ELECTRIC AUTOMOBILES.

There are 44 of the schedules that are answered in the negative sense, with a definite reason why; and all of these reasons relate to the nature of the country. It is stated that the country is too mountainous or too hilly, that there is too much sand, or that the roads are too bad. No fewer than 21 of the companies report adverse hilly conditions, in 14 different States. Asheville, N. C., says that "The hills of western North Carolina are, or seem to be, almost too heavy for the electric automobile. There have been a few at different times, but they have not proved good." The Northern Westchester Lighting Company, of Ossining, N. Y., remarks: "On account of hills, no electric automobiles in territory. This company had an electric truck which was not satisfactory." Winchendon, Mass., says: "There have been first and last three electric automobiles brought into this town. They have all proved a failure on account of the country being somewhat hilly. While we have a great many automobiles in town, the electrical machine is not even considered." Staten Island, N. Y., does not admit that its steep grades are altogether prohibitive, but notes "Very few electrics used on Staten Island. Country very hilly." Ithaca, N. Y., is more positive to the effect: "Too many hills in this country for electric autos," while Eureka Springs, Ark., admits explanatorily: "There are no automobiles in this city, as it is all mountainous; not a hundred square feet of level ground here."

The roughness of the country is also alleged in several instances, although this would appear to be a superficial objection incident to the condition of the roads rather than the state of the pastures and woodlands. Thus Biddeford, Me.: "Electric automobiles have not been sold in this town. The surrounding country is very rough." In like manner Bedford, Ia., says: "No electric cars in this country; too rough." Sebewaing, Mich., and Colville, Wash., concur, using the same language. Others are very frank, however, as to the state of the streets and roads. A typical example is Nacogdoches, Tex., the company saying: "We have no autos of any kind. Our streets are all deep sand and it is impossible to operate machines of any kind. If we ever have our streets paved, we may have some machines." Del Rio, Tex., where there is a power circuit, says: "Our roads and streets are such that no one has attempted to run an electric automobile." Russellville, Ark., says that its roads were so bad that all the automobiles in the place were sold some time ago, including the gasolines. There are several other sad commentaries on American city thoroughfares, and some on rural roads. Henderson, Tex., allows: "This country is not at all suitable for automobiles. Deep sand, and hilly and rough." The Southern Colorado Power & Railway Company, of Trinidad, says: "There were three electrics here at one time, all owned by parties interested in the electrical business, but conditions are not favorable, so they were changed for gasolines." The Northern Light Electric Company, Wahpeton, N. D., remarks: "No electric automobiles here. Wahpeton has no paved streets, and automobiles are required to make long trips into the country; therefore, electrics are not well adapted for use here." But the limit of unavailability seems to be reached in one section of Arkansas, of which the Harrison Electric Light & Ice Company reports: "This country is not adapted to autos—no autos at all—not a bridge in five counties." Under such circumstances, the management does well to boom ice making in preference to charging autos. The Danville (Ky.) Light, Power & Traction Company is very pessimistic in its point of view: "We are located in an extremely hilly country, and have not faith in the electric ourselves"; but one can be more cheerful with the Watauga Electric Company, of Johnson City, Tenn.: "Have no electric autos in town; roads too bad. Hope for better things soon."

VARIOUS ANTAGONISTIC CONDITIONS.

Another large batch of answers to the schedule may be put into a general group of "Objections, Doubts and Inquiries." Of these there are no fewer than 64 of a very miscellaneous character. It is stated by the Citizens' Gas, Electric & Power Company, of Nantucket, Mass., that there are no electrics for the reason that all automobiles are barred from the island from May 1 to Oct. 1 of each year by law. Bar Harbor, Me., reports: "There are no automobiles here of any kind. We have a law prohibiting their use." A strenuous comment of the same kind comes from the Gardiner (Mont.) Electric Light & Water Company: "We live on the edge of the Yellowstone Park, and until it is opened to autos nothing will be done. Why don't the auto builders demand that it be opened to all alike? Get after your Senators and have it done." These statements one can understand, but it is rather difficult to follow the objection made in several instances, on the ground that "this town is too small." Thus, the manager of a company in Connecticut writes: "They hardly seem practical to me in a small town for private use." Of the same tenor is one from Illinois: "This is a very small town, and while there are quite a number

of automobiles here, the people are very prejudiced against the electric vehicle." A writer in Wilbur, Wash., is more explicit, but does not throw much light on the basis of this objection, which is apparently less real than imaginary: "There are no electrics in use in our territory. The town is perhaps too small for this kind of machine, only having a population of 1500. Those who have use for automobiles desire machines that can run several hundred miles; consequently the gasoline machine is all the go." Difficulties of securing gasoline suggest themselves, however, almost as much as the lack of charging stations, when it comes to long-distance travel.

Various other remarks betray apathy and indifference that seem a little remarkable; and a readiness to take it for granted that the electric has no chance. Thus, for instance: "No call for electric machines." "Twenty-eight automobiles in Hammondsport, N. Y., and not one electric. No one here would have one." "At the present moment all cars in use are gasoline machines, the electric not having proven its adaptability to country conditions." "We have nothing to do with outside issues. We light the streets." "There are no electrics here at present, as they are so much more expensive than gasoline cars. We have never made any rates for them." "There is not an electric auto in this city. People do not seem to want them on account of their limited mileage." "There are no electric vehicles in this section. The initial cost is too much for our people to invest in." "Have no electric automobiles. There seems to be a lack of confidence in them." "No electrics in town; have had a sample machine, but could not sell it."

ON THE INQUIRERS' BENCH.

It is obvious that the preceding objections and criticisms are made in good faith, but one would hardly choose their authors as leaders of forlorn hopes or as comrades in a search for the North Pole. Even so practical a matter as the improvement of the load factor requires some courage, something adventurous in spirit; hence it is encouraging to note that just two score of the schedules indicate a desire for information, a willingness to investigate, a readiness to lend a hand for the common good. These cheering evidences of a feeling that the electric automobile has some merits come from widely scattered points in Arizona, California, Colorado, Georgia, Idaho, Indiana, Illinois, Iowa, Kansas, Maine, Massachusetts, Mississippi, Montana, Missouri, Nebraska, New Mexico, New York, Ohio, Oklahoma, South Dakota, Texas and Virginia. Many of the writers are not merely willing to "help the movement along," or "are interested in establishing this department," but are desirous of taking agencies for the sale of automobiles. This opens up a large question, but as 50 per cent of the central stations in the country handle supplies and sell apparatus there seems no good reason, from their standpoint, why they should not do this, just as they would install motors or fix up a big sign. The attitude of the automobile manufacturer to this proposition is another matter. One correspondent says: "Send me address of some responsible company that manufactures electric machines that sell at moderate price, and who would probably desire a selling agent at this place. We have ample facilities for charging batteries." This is typical of many others, waiting for help. Some go out and get what they want. "I have written to a number of builders of electrics for catalogues, etc., with a view of seeing what can be done in our city with them. Would be glad to have any information I can get concerning their use." Or this: "The manager of the company has the agency for an electric automobile and hopes to sell some cars this season." Such a position brings up the question, of course, whether the manager will sell a machine that is best for the customer, or primarily best for the manager to sell; and, next, whether the most helpful policy is that of working up a "prospect" and then getting him or advising him how to get just what he needs. Another company says: "We are endeavoring to sell electric machines and will handle supplies if we can do any business." A further example of broad gage policy is this: "We are preparing to equip our plant with charging apparatus, and will be glad to have the co-operation of all interested in furthering the industry." From Oklahoma comes this: "Would like literature as to rates, cost, etc., of maintenance of electrics, and would like to become agents for some good electric machines." A practical inquiry from Ohio runs thus: "We have an inquiry from our local automobile garage asking as to the cost of an equipment for the purpose of charging electric automobiles. They claim that they have some five to ten prospective customers, provided a charging outfit be installed, and are very desirous that we shall install one, as the community is not large enough for more than one charging set." Then follow details of the system. Another station in New York State remarks: "This company desires information and expects to install equipment and sell electric vehicles, through its commercial department." Out in Nebraska, a local company says: "A dozen electrics could be sold in this city." Why not sell them? A company in Mississippi shows the right spirit when it says: "We have been thinking of buying one for our own use in order to introduce them here." If each company did that, it would make a market for nearly 5000 machines during the next year and bring the price down very appreciably. Another company in Illinois has the same feeling: "We have thought of getting an electric auto, together with the agency, and rig up for charging the same." And this is also excellent: "There are no electric automobiles here, but we have plans under way which we expect will result in the use of quite a number." Similarly, from Illinois, comes this: "We are anxious to do what we can to help this branch of our business. As there has been no local demand for such a service, we have not prepared for it, but we believe there is a good future, and shall be glad to work with other central stations to develop it. Shall be pleased to receive your suggestions." A third Illinois comment is kindred: "Not in the electric yet, but talking it up; expect it to develop later." Out in Idaho, a station says: "No electric automobiles in this city, but this company is contemplating the purchase of one or more." A significant evidence of interest is that given by the Athens (Ga.) Electric Railway Company, which says: "We will appreciate any information that will assist us in building up this field."

CHARGING IGNITION BATTERIES.

Before passing on to consider the data obtained relative to the electrics themselves, the fact must be noted that several central stations while doing nothing as to such business state that they do derive some revenue from the charging of batteries for ignition in gasoline machines. Returns to this effect were received from no fewer than 61 companies. With some of them it is still merely incidental; with others it has become a specific, if small, source of income. At Hillsboro, N. H.: "Occasionally our electrician charges a storage battery for which he may receive a tip, or charge for his services; no income to company." At Alliance, Ohio: "We have no electric automobiles in this city, and the only charging is done for storage batteries for spark coil. Although we have facilities for doing same, it does not amount to more than $5 or $10 a year." The Kenmare, N. D., station puts its receipts from this source at about $100 a year. On the other hand, the Telluride (Col.) Power Company says: "We have charged two or three ignition batteries for stragglers who have entered too far into the mountains, but have rendered no bill." At Rumford, Me.: "We are looking for more business, and last year arranged for charging ignition batteries." Lockhart, Tex., reports receipts of $18 a year from this source, and does it by putting the batteries in series with lamps, which does not sound profitable, though it may accommodate friends, as one of the officers of the company sells gasoline automobiles. At Plymouth, Ind.: "We charge a great many batteries for ignition and do it on the exciter." The income at Albert Lea for ignition battery charging is $75, the work being done through a rheostat. One company reports about 250 gasolines in its city, and that it earns $50 a month charging the batteries with a small rectifier. At Lyons, Kan., 50 batteries per month are charged. At Grundy Center, Ia., there are 40 gasoline cars, of which 20 have batteries charged by the local plant, at a rate of 7 cents per kw-hour. It is stated from one place in Montana,

by the local company, that the sparking storage batteries are charged by the telephone company.

A variety of prices are paid to the stations for this work, which may be briefly noted as follows: Phillipsburg, Kan., $1 per battery; Salinas, Cal., $1 per charge; Cory, Pa., 50 cents per battery for storage batteries of three cells; Albert Lea, Minn., 75 cents per charge; Ottawa, Ohio, $1; Mineral Point, Wis., $1 for a three-cell battery; Victor, Mont., $1 a charge; Humboldt, Neb., 75 cents each; Taylor, Tex., $1 per charge; Oakland, Ill., 50 cents, 60 amp-hours; Rangeley, Me., 25 cents per cell; Vinita, Okla., 50 cents each; Mt. Carmel, Ill., "getting about 12 cents for charge of current"; Waterford, Pa., 50 cents per three-cell battery; Richmond, Ohio, 50 cents per battery; Kent, Ohio, 50 cents per charge; Ellenville, N. Y., 50 cents apiece; Calvert, Minn., 50 cents. These differences seem to be quite arbitrary, and not to have any particular relation to the cost of current or amount of business.

USE OF RECTIFIERS.

In view of the fact that so many central stations employ alternating-current dynamos only, it was recognized that they could not very well undertake to handle electric automobiles, and that many of them had already introduced the modern arc rectifier as a means of solving the problem. Hence one of the questions in the schedule of inquiries related to this class of apparatus, in connection with electric automobile work. It is not altogether certain that the inquiry was accepted or understood in the spirit in which it was put forward, as many of the stations responding appear to regard it as applying to all purposes for which this new and ingenious apparatus can be utilized. The answers, while all proffered in good faith, must not, therefore, be considered as strictly relevant in every case to the general purpose of this census. The question would have been clearer if instead of merely asking whether the company installed and sold rectifiers, the words had been added, "for automobile charging purposes." But, subject to this possible revision, the figures may be accepted as interesting and significant. Outside of the companies which report themselves as actually interested in automobile work, no fewer than 66 reply that they have taken up the introduction of rectifiers or are ready and willing to do so. Some of them state specifically that this adoption of the rectifier is for the purpose of charging storage batteries. Others say: "We are endeavoring to get into this line"; "We will if we can interest any one to make the installations." "Expect to soon"; "Will if demand can be created"; "Would sell and install if we had a chance"; "Have had inquiries but no sales as yet"; "We are preparing to do so"; "Some may be interested this season." A good deal of business in this line would seem to be latent, not far from the surface and waiting development. The responses to this inquiry are of general and widespread origin, and come from Arkansas, California, Connecticut, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Massachusetts, Michigan, Minnesota, Montana, Missouri, Nebraska, New Hampshire, New Jersey, New York, Oklahoma, Ohio, Oregon, Pennsylvania, South Dakota, Texas, Vermont, Washington, Wisconsin. Of the returns, 27 quote prices for electrical energy, but this subject will be taken up under another head.

One of the most interesting examples of the introduction of rectifiers is furnished by Toledo, Ohio, where at one time only direct current was available with rheostats, but where the extension of alternating circuits has rendered it possible to use the new device. The Railway & Light Company has already installed 25 in private garages, and a large number in public ones—as many as eight in a single instance, with two more to be added. The company sells a 20-amp rectifier for $230 and a 30-amp for $250. A reduction of $20 is made from the price if the purchaser undertakes to install the rectifier himself.

THE NATURE OF THE INQUIRIES.

The form of census blank used by the *Electrical World* in this investigation included 18 questions which were as follows: (1) Name of Company and Location; (2) Number of Public Electric Garages in City; (3) Number of Garage Electrics Cared For; (4) Number of Public Garages on Company's Circuits; (5) Number of Private or Isolated Electric Automobiles Charged by Company; (6) Number of Automobiles Not Charged by Company and How Charged; (7) Rates to Public Garages for Current; (8) Rates to Private Automobile Owners; (9) Gross Amount of Company's Income; (10) Number and Capacity of Company's Own Electrics; (11) Number of Electric Automobile Dealers in City; (12) What Makes of Automobiles and Batteries Are Used?; (13) What Rates Do Garages Charge?; (14) Does Company Handle Automobiles or Supplies for Automobiles?; (15) Have You Any Special Automobile Official?; What Are His Duties?; (16) How Are Batteries Cared For?; (17) How Is the Current Supplied? What Is the Garage Equipment?; (18) Do You Sell and Install Rectifiers? The company was also asked to send in any literature, advertising or published automobile charging rates. These questions were prepared with considerable care, and submitted to experts before adoption, but it was not expected in some instances to elicit much definite data, though it was thought, and has happened, that the very fact of asking the question would set local companies thinking on the subject. Two of the questions have caused confusion in the minds of many, though one of them is quite definite. It was asked, as above, how many electric garages there were in the city, and next, how many were on the company's circuits. In several instances the answers to these questions include not simply electric garages, but every garage connected to a given company's mains if it happens to be a customer for current. Now in some instances this patronage is quite heavy, worth getting, and might well lead on to the inclusion of electric automobile service. Thus the Queens Borough Gas & Electric Company, of Far Rockaway, Long Island, reports connection with 13 garages in its territory, but says: "All the garages are almost entirely engaged with automobiles of the gasoline type, the electrical being the exception. Our power is used for charging sets, and for motors used for the general repair work and for elevators; also for lighting." In many ways this may be regarded as a typical case, but it will be seen that such answers tend to vitiate the accuracy of any statement as to the number of electric garages, conducted as such.

Over 250 of the companies addressed sent in data as to work of their own, work done in their vicinity, rates, and other points of interest, these being additional to those already enumerated except a few of those already discussed as to rectifiers, the inquiry with regard to which was given a broader meaning than intended. It seems best for the purpose of summarizing the data to take up the answers to each question as a whole, and to close this analysis with a few general remarks. Before doing this it may be stated that in addition to the 250 returns now to be considered, the Electric Storage Battery Company of America reports 154 additional names, as the result of special inquiries of its own, these being companies that have manifested a distinct interest in the new work. It will be seen, therefore, that, one way and another, nearly 500 central station companies are aroused as to the possibilities, and many of them are building up a new "load." Unfortunately a few of the larger cities have failed to reply, although written to more than once on the subject because of their known activity in the field; but it is a familiar fact that in many instances the traditional policy of never disclosing information about a company's affairs still prevails, an attitude that inquisitorial legislation has done something to encourage. The returns dissected below originate as follows: Alabama, 1; California, 8; Colorado, 6; Connecticut, 6; Delaware, 1; District of Columbia, 1; Georgia, 2; Illinois, 22; Indiana, 13; Iowa, 9; Louisiana, 2; Kansas, 7; Maine, 1; Maryland, 2; Massachusetts, 21; Michigan, 12; Minnesota, 3; Missouri, 6; Montana, 1; Nebraska, 4; New Hampshire, 3; New Jersey, 7; New Mexico, 1; New York, 32; North Carolina, 5; Ohio, 16; Oklahoma, 3; Pennsylvania, 18; Oregon 1; Rhode Island, 1; Porto Rico, 2; South Carolina, 1; South Dakota, 3; Tennessee, 3; Texas, 8; Utah, 1; Virginia, 3; Washington, 3; Vermont, 3; Wisconsin, 8, and Wyoming, 1. We

thus have no fewer than 41 of the States and Territories represented in the returns, making the contemporaneous picture a very comprehensive one.

NUMBER OF PUBLIC ELECTRIC GARAGES.

Note has been made above as to the slight misapprehension arising in regard to this question, and the tendency to consider a garage electric if it receives any kind of electric service. But the internal evidence of the data is helpful in such cases. The Los Angeles (Cal.) Gas & Electric Company reports 5 on its circuits giving electric service, and notes that there are two other companies in the city. At Sacramento, Cal., there is one. The Denver Gas & Electric Company reports 13. The Potomac Electric Power Company, of Washington, D. C., reports 17; Savannah, Ga., 3; the Commonwealth Edison Company, of Chicago, 30; North Shore Electric Company, Chicago, 9; Rockford, Ill., 6; Peoria, Ill., 2. Freeport, Ill., says: "There are three electric machines in Freeport, of which two are charged in our power house, and one by an individual rectifier." Kewanee, Ill., 2; Paxton, Ill., 1; La Harpe, Ill., 2; Evansville, Ind., 3; Lafayette, Ind., 2; Vincennes, Ind. "Four public garages in the city, none of them strictly electric; two carry electrics." Marion, Ind., 2; La Porte, Ind., 1; Burlington, Ia., 1; Davenport, Ia., 4; Des Moines, Ia., 5; Osceola, Ia., 1; Waterloo, Ia., 3; New Orleans, La., 10; Peabody, Kan., 1, "party is putting in a small dynamo and gas engine"; Wichita, Kan., 2; Baltimore, Md., 3; Boston, Mass., 15, "in addition most ordinary garages take electric cars as well, but are not fitted for looking after batteries"; Brockton, Mass., 5; Fall River, Mass., 2; Gloucester, Mass., 2; Haverhill, Mass., 2; Lynn, Mass., 8, "none that are wholly electric; a number care for electric machines; in three instances have supplied motor generator sets to garages to use in charging"; Manchester, Mass., 2; New Bedford, Mass., 8; Newton, Mass., 3; Springfield, Mass., 5; Salem, Mass., 2; Adrian, Mich., 1; Ann Arbor, Mich., 1; Battle Creek, Mich., 4; Detroit, Mich., 35, "fifteen use our service for charging, every garage in town has service from our lines for light and power"; Port Huron, Mich., 2; Sheboygan, Mich., 2; Duluth, Minn., 3; Minneapolis, Minn., 6; St. Paul, Minn., 8; St. Louis, 6; "has also large public garage of its own"; Kansas City, Mo., 2; Beatrice, Neb., 1; New Jersey: "We have very few of these charging outfits, and I doubt if there are more than 25 in the entire State. These are placed back of the meter and charged for at regular rates." Atlantic City, N. J., 1; Lakewood, N. J., 3; Ridgewood, N. J., 1; Camden, N. J., 1; Brooklyn, N. Y., 16; Ellenville, N. Y., 1; Niagara Falls, N. Y., 8, "combination"; Fillmore, N. Y., 1; Buffalo, N. Y., 3; Far Rockaway, N. Y. (Queens Borough system: New York City, 8; Nassau County, 5; see reference above); Gloversville, N. Y., 1; Geneva, N. Y., 1; Hudson, N. Y., 2; New York City, 30; Patchogue, N. Y., 1; Rochester, N. Y., 14; Rome, N. Y., 1; Watertown, N. Y., 1; Charlotte, N. C., 1; Durham, N. C., 2; Raleigh, N. C., 1; Bucyrus, Ohio, 1; Cincinnati, Ohio, 7; Dayton, Ohio, 4; Elyria, Ohio, 3; Lorain, Ohio, 3; Marion, Ohio, 2; Massillon, Ohio, 2; Piqua, Ohio, 2; Springfield, Ohio, 2; Warren, Ohio, 1; Youngstown, Ohio, 2, "on a very small scale: do not charge more than 3 or 4 cars each"; Oklahoma City, Okla., 8; Harrisburg, Pa., 1; Hazleton, Pa., 2; Johnstown, Pa., 3, "all garages care for gasoline and electric machines together"; Pittsburgh, Pa., 6; Lancaster, Pa., 4; Sunbury, Pa., 1; Philadelphia, 10; Scranton, Pa., 1; Warren, Pa., 1; Waynesboro, Pa., 2; West Chester, Pa., 1; Portland, Ore., 2; Ponce, Porto Rico, 1; Providence, R. I., 2; Aberdeen, S. D., 3; Memphis, Tenn., 4; Nashville, Tenn., 1; Beaumont, Tex., 2; Galveston, Tex., 2; Granberry, Tex., 2; Houston, Tex., 1; San Antonio, Tex., 2; Victoria, Tex., 1; Salt Lake City, Utah, 5; Norfolk, Va., 2; Roanoke, Va., 3; Richmond, Va., 1; Seattle, Wash., 2; La Crosse, Wis., 3; Kenosha, Wis., 1; Oshkosh, Wis., 2; Oronto, Wis., 2; Cheyenne, Wyo., 1.

It is not quite clear from the returns that all of these are distinctively electric garages, although the great majority undoubtedly are. An attempt to distinguish garages where electric connection exists with central station circuits so that automobiles could be charged if desired gives an interesting group of 83 garages in addition to those above, located as follows: Selma, Ala., 1; San Bernardino, Cal., 1; Salinas and Monterey, Cal., 3, "for ignition"; Oxnard, Cal., 1; Pueblo, Col., 1; Bridgeport, Conn., 9; Laurel, Del., 1; Brunswick, Ga., 1; Farmington, Ill., 1, "ignition"; Beardstown, Ill., 1; Belleville, Ill., 1; Boswell, Ind., 1; Kokomo, Ind., 5; Crawfordsville, Ind., 4; Muncie, Ind., 2; Clarinda, Ia., 2; Clinton, Ia., 5; Minneapolis, Kan., 2; Arkansas City, Ark., 2; Sanford, Me., 2; Everett, Mass., 7; Newburyport, Mass., 3; Anaconda, Mont., 2; Grand Island, Neb., 2; Portsmouth, N. H., 4; Morristown, N. J., 6; Glen Cove, N. Y., 1; Wilmington, N. C., 3; Kenton, Ohio, 2; Chester, Pa., 1; Spokane, Wash. "The electric automobile business has not had much attention in Spokane. There are a few automobiles in use, the number of which I do not know. There are no exclusive electric garages. I hope within another year to be able to make a better report." Superior, Wis., makes a statement that is interesting: "One garage in city; handles no electrics. One electric automobile owned by the superintendent, electric department, this company; charged from an isolated electric plant at no cost to owner."

In addition to all the facilities for charging thus afforded, note must here be made of some described recently in the *Electrical World* and belonging properly in this census. It appears from this additional data that at Orange, N. J., there are 10 garages, four of which have charging arrangements. There are three at Elizabeth, N. J., and at least one at Newark, N.J., as well as one at Englewood, N. J. It is stated that at Hartford, Conn., one of the great centers of the automobile industry, there are about 12 commercial garages all equipped with charging facilities, while "the facilities in the surrounding country are also good." Several of the garages in Indianapolis are on central station circuit, having charging facilities, but the number is not given. Toledo, Ohio, reports 9 public garages which charge and care for electric vehicles. Cleveland, Ohio, a notable "home of the auto," has a large number of garages where charging can be done, but no exact figures are obtainable.

AUTOMOBILES CHARGED BY GARAGES.

It is natural that the information in the possession of the central station companies should be very vague as to the number of automobiles charged in the garages on their circuits. Still, it was thought worth while to ask the question if only as a means of stimulating interest in the matter. The 250 schedules now under consideration do not all of them contain answers to it, but the 87 that do reply give a total of not less than 2827 machines. Hartford, Indianapolis, Cleveland and Toledo are not included in these totals, as the number of automobiles in each place charged by the garages is not quite distinct. At Hartford, Conn., there are upward of 100 electrics for pleasure service charged from the mains of the local company. The number charged by the garages, also, is not given, but it should be considerable. At Pasadena, Cal., there are about 200 electrics, but here again no division is made. Toledo, Ohio, has between 400 and 500 electrics, and as there are 85 private garages it would not be unfair to credit 400 vehicles to the garages. There are about 160 electrics in Indianapolis, but no distinction has been made. The number of electrics in Cleveland is definitely stated to be in excess of 1000 and may be 1200, but no division can be reached, although it is said that there are at least 300 private garages in the city and suburbs.

Meantime, it is encouraging to find as many as 2827 vehicles in the public garages of 87 towns and cities, especially as Washington, D. C., Denver, Col., and Philadelphia, Pa., are not included, for the reason that the numbers do not appear to be ascertainable. Under the circumstances, therefore, it becomes difficult to determine the total number of electrics in any place and the ratio or proportion to the population. This is certainly an interesting point. Thus Rockford, Ill., claims a total of 130, or 2.6 in 1000 population, of 50,000 to the city, while Pasadena, Cal., with a population of 15,000, claims about 200 electric vehicles, or 13 per 1000 at least.

It may be added that in the total of 2827 public garage electrics thus brought to account, 453 are credited to Chicago and district; 650 to New York City (Manhattan Island); 300 to

Rochester, N. Y.; 200 to Detroit, Mich.; 100 to Minneapolis, Minn.; 50 to St. Paul, Minn.; 80 to Boston, Mass.; 40 to Des Moines, Ia.; 25 to Springfield, Mass.; 30 to Galveston, Tex.; 80 to St. Louis (the company's own garage); 53 to Kansas City, Mo.; 180 to Buffalo, N. Y., and 100 to Pittsburgh, Pa. These constitute a large percentage, but on the other hand 16 of the garages reported elsewhere charged only 1 vehicle each off station circuits. It should be noted that there are no data from San Francisco, but that is the only very large city absent from the returns, as the others not included in the total of 2827 are able to give information as to the private charging, which will be considered next.

CHARGING OF PRIVATE AUTOMOBILES.

The inquiry with regard to the number of automobiles charged by the companies for private parties elicited considerable data, and more than was expected; while the amount of information furnished as to electrics "not charged by companies" is also unexpectedly full. A very large number of vehicles are brought to account in a manner which shows deep interest in the subject and a close study of its possibilities. Only one unsatisfactory note is struck as to absence of development, and that is in the case of Charleston, S. C. At one time there were three public garages in the city where charging could be done. Now there are not any, although the company charges two private vehicles. The extraordinary reason given is this: "Up to some months ago about 25 electrics were in use in the city, when a number of comparatively new second-hand gasolines were brought to the city by trading agents, who exchanged gasoline cars for electrics, taking in all the electrics but two." It may be hoped that the near future will see a rally from this curious blow, as Charleston, with 4-cent current, would seem to be a place where the electric can certainly hold its own.

In the case of many of the companies replying to these two questions a confusion existed as to how to separate them; and in several instances if a rectifier was used the company reported that machine as not charged by itself; whereas the object of the distinction in the inquiries was obviously intended to bring out the number charged by isolated plants. No fewer than 175 stations answered one or both questions, showing the remarkable total of 3490 machines, outside of public garages. Of these, apparently 953 were not charged by the companies, but the real number of "isolated" machines was much less, chiefly for the reason just noted, the answer in various instances being "automobile charged by private rectifier." In the case of Chicago, it is stated definitely that 105 private electrics are charged by the company, and 197 by isolated plants where gas or gasoline engines are used. In the case of Rockford, Ill., only 82 of the 130 in town are accounted for as being on the company's circuits, but as there are 55 private garages in the city, the difference is at once accounted for. St. Louis, Mo., reports definitely that about 60 machines there are charged from private plants, but both Boston and Philadelphia decline to make any statement or estimate, owing to the difficulty of knowing what is actually connected "back of the meter," and of eliciting the real facts in regard to what is done at isolated plants in the territory covered—in the case of the Boston system a large part of Massachusetts, owing to the extensive suburban consolidations. Detroit, Mich., on the other hand, has definite information on the subject and reports 90 as charged by itself and 200 as cared for by the garages, with none from isolated plants, although it does not seem unlikely that there may be some in the city. Kansas City, Mo., reports approximately 60 auto lines, with rectifiers, but states there are no others, except those in garages. It is not impossible that such reports overlook isolated instances, especially automobiles of the industrial type, many of which are charged from isolated plants in breweries, factories, large dry goods stores and are duly listed from time to time as such by the manufacturers. The case becomes particularly difficult in a place like Greater New York, where many vehicles of this type might easily exist unknown to the local companies, unless an expensive investigation were made at every isolated plant. The number for New York City of pure "isolated" electrics is given as 200 and for Brooklyn, 12. At Schenectady the 10 "isolated" of which note is made are all those of the General Electric Works. Cincinnati, Ohio, states that it does not know the number outside garages. It charges 25 directly and estimates the isolated ones as possibly "about 15, mostly motor trucks owned by manufacturers and charged from private plants." At Providence, R. I., the schedule reports 50 as not charged by the company, and none charged by itself, outside garages. At Buffalo as many as 125 are in large garages with isolated plants, but there are 535 machines in the city.

In addition to the vehicles enumerated above, there must be added at least 45 for Hartford, Conn., on the company's mains; 200 in Toledo, outside garages; 800 to 1000 in Cleveland; at least 100 in the New Jersey territory of the Public Service Corporation. In short, the data for 250 cities in the United States would indicate about 5000 electric automobiles, outside of those in the garages, which are counted separately; and would also indicate that in these places perhaps 750 are charged from isolated plants—i.e, not less than 10 per cent, and possibly somewhat more.

CENTRAL-STATION INCOME AND RATES.

Most of the 250 companies give their rates; very few name their income from charging. The returns enumerated above disclose not less than 8000 machines, all told, which at $50 a year per machine, as an average, would yield $400,000 for current. It is certainly safe to assume not less than 10,000 machines for the whole country, which at the same average would yield $500,000. Taking Rockford, Ill., as an average case, the return was $60 per year, but the private electrics did not yield more than $42.50. Denver, Col., reports that the machines on its circuits average $60 a year. Washington, D. C., reports its known income from this source—the Potomac Electric Power Company—as $28,000. The Chicago Commonwealth Edison Company reports $24,000. Savannah, Ga., reports an income of $300 a month. Des Moines, Ia., gives $1,682 for 1908. Baltimore, Md., like many other companies, cannot well go "back of the meter." "Our contracts being based on the installation or demand, which takes in all meters on the customers' premises, it is impossible for us to state the amount of income derived from electric machines." Boston has "no record" and offers no estimate, while Brockton, Mass., knows it to a cent—$985.73. At Salem, Mass., the specific income already averages about $900 a year, and at Springfield, Mass., about $2,500. Detroit, Mich., reports "approximately $10,000 and growing." Minneapolis, Minn., says: "Approximately $12,000 a year," and St. Paul, $2,400. One of the most striking reports is from St. Louis, Mo., which reports "about $79,000 per year, including repairs on automobiles and also receipts for current from private and public garages." Kansas City, Mo., reports $8,000 a year. The Brooklyn (N. Y.) Edison Company reports a gross automobile income of $25,000 a year, but the other systems in New York State that they cannot estimate it or that it is not segregated. It may certainly be put at not less than $100,000 a year, assuming about 1400 machines at only $75 a year—a low average where so many of the vehicles are in constant use. Rochester, N. Y., puts its automobile income for 1908 at $19,796, which would indicate there about $40 per machine. Youngstown, Ohio, averages approximately $160 per month; Harrisburg, Pa., $200; Portland, Ore., $60. The income at Providence, R. I., is placed at $1,500 a year. Savannah, Ga., places its income from this source at $300 per month, and Galveston, Tex., between $300 and $400. Salt Lake City computes it at approximately $125 per month. Norfolk, Va., $60 per month. It would appear from the reports that in many instances an income of $100 per machine per year can be earned. The average bill of one customer in Jersey City for energy consumption, over 12 months in 1908-9, was $8.31, and other data show a like average elsewhere. It all depends on the price for current and steadiness of use.

That leads up to the question of rates. Out of the 250 schedules of companies directly interested, 192 gave data as to rates, some of them very fully. Several state that the rates are the same as the regular power rates or lighting rates, but do not quote those rates. The range of price is very wide, and

is governed, of course, more or less, by the terms of discount. The following is a summary of 103 mentioning a flat price for charging, but not quoting any discount in connection therewith: 1 at 2 cents; 3 at 3 cents; 1 at 3½ cents; 7 at 4 cents; 2 at 4½ cents; 31 at 5 cents; 1 at 5½ cents; 12 at 6 cents; 7 at 7 cents; 1 at 7½ cents; 10 at 8 cents; 1 at 9 cents; 23 at 10 cents; 1 at 12 cents; 3 at 15 cents; 1 at 16⅔ cents, and 1 at 20 cents in New Mexico.

Sliding scales and discounts are reported from 21 places. In one instance the rate of 7 cents per kw-hour is subject to 10 per cent discount for prompt payment; and 5 cents in another. One rate slides from 15 cents to 7 cents; another from 15 cents to 10 cents. Nine of the rates range downward from 10 cents to 2 cents. One 9-cent rate falls to 6 cents and another to 2 cents. One 8-cent rate scales down to 4 cents and one 7-cent rate to 3 cents. The lowest of the sliding scales is that in which the range is 5 cents to 1¾ cents. Buffalo quotes 6 to 2 cents. There are some time limitations.

The above rates show abundant variety, but 68 cities and towns report other rates, some of which are very elaborate as applied to a relatively simple proposition. Thus, in Denver for public garages the rate is 4 cents; or $25 per year per horse-power connected, plus 3 cents per kilowatt, less 10 per cent discount. It is also 4 cents for the more "simple life" private consumer, but the minimum monthly bill must not be less than $5 net. In Washington, D. C., under a guaranty of $25 per month the rate ranges for public garages from 5 cents for the first 1000 kw-hours monthly down to 3 cents for all above 2000 kw-hours. The private owner guarantees $2.50 per month for each meter installed, 10 cents per kw-hour up to $4.95 per month and 5 cents for the excess. Savannah, Ga., gives public garages 2 cents net and private owners a sliding scale of 7 cents to 3 cents. In Chicago, the public garage is on the regular Wright demand 10-5-3 contract with a guaranteed maximum rate of 5 cents if the customer agrees not to charge batteries between 4 p. m. and 6 p. m.—lighting peak. The Commonwealth Edison offers also its low wholesale power contract to large garages using long-hour service. Private owners are on the same 10-5-3 basis of contract, the minimum bill not to be less than 66⅔ cents for each kilowatt of maximum demand, and no bill to be less than $1.50. The adjacent North Shore Electric Company charges public garages 4½ cents per kw-hour, and private owners 10-8-6-4-3 cents sliding scale, with 85 per cent rated capacity of rectifiers as maximum demand. In Rockford, Ill., public garages get a 4-cent-off-the-peak-charging clause, and private owners 6 cents. At Clinton, Ia., the regular lighting rate is charged, beginning at 12 cents per kw-hour, with scale of discounts. Davenport, Ia., gives public garages 5 cents to 3 cents and private owners 6 cents. New Orleans makes it 4½ cents and 6 cents; Wichita, Kan., 10 cents and 8 cents, with a sliding scale to 4 cents and 3½ cents. In Baltimore, Md., standard rates are charged: "being 10 cents per kw-hour for the first 50 hours' use of the connected installation or demand and 5 cents for all in excess of that, subject to discounts provided in schedule, in steps of 1/10th of a cent, according to the size of the installation." In Boston, Mass., the rate runs from 12 cents down to 2 cents for public garages under a commercial schedule of rates, and private owners get the same, but on account of small use it usually runs with them from 12 cents to 8 cents. At Lynn, Mass., the general charge for both classes is 8 cents for alternating current supplied to rectifiers and 10 cents for direct current supplied from rectifiers. The Malden, Mass., company charges public and private garages 15 cents, but the public can get it for 6 cents between 9 p. m. and 5 p. m.—or off peak. Manchester, Mass., "soaks" private customers 25 cents per kw-hour for less than six months and 15 cents if they are customers over six months; while the rate to public garages is 15 cents. Springfield, Mass., makes it 3 cents to public garages and 6 cents to private, while Detroit, Mich., makes it 3 cents and 5 cents. On the other hand, Sheboygan, Mich., reports that it makes the rate 6 cents to private owners and 10 cents to public garages, which if correct implies a desire to get the business directly. Duluth, Minn., makes it 3 cents to public and 6 cents to private, with a minimum in the latter case of $5 per month. Minneapolis, Minn., gives all alike its regular power rates of 7½ cents for the first 52 hours and 2½ cents above, with 5 per cent to 25 per cent discounts for quantity. Bowling Green, Mo., quotes 5 cents per kw-hour, 12:30 a. m. to 4 p. m., on a time switch. At St. Louis, Mo., the rates are variable for public garages, from 5 cents to 3 cents and for private from 10 cents to 6 cents. Kansas City, Mo., makes it 3 cents and 5 cents, with a minimum for the private owners of $5 per month. At Atlantic City, N. J., the public garage gets "various rates according to consumption and demand," while the private owner pays from 16 cents to 8 cents. In Brooklyn, N. Y., the average rate earned from public garages under the discount scale employed is 6½ cents; with private owners it averages 8 cents. "Large consumers for commercial purposes earn a 4½-cent rate." The round rate at Niagara Falls, N. Y., is 3 cents. The Queens Borough (N. Y.) Gas & Electric Company makes an all-around automobile rate of 6 cents; its lighting rate is 15 cents. The New York Edison Company has a special automobile and storage battery contract with rate beginning at 6 cents with a minimum monthly charge of $50 per installation, and with a liberal scale of discounts. The automobile rate of the United Electric Light Company is about the same. If the consumption does not warrant it, the customer can fall back on the 10-cent regular rate, with its discounts. The automobile scale discounts go up to 50 per cent—3 cents—with a consumption of 50,000 kw-hours monthly. There are provided time limits in November, December, January and February. Rochester, N. Y., charges private owners 6.3 cents net and asks a guaranty of $2 per month. The public garage is subject to a guaranty of $12 per month. According to quantity the price for day charging is 3½ cents to 7 cents and for night charging 2 cents to 4 cents. Cincinnati makes a rate under its power schedule—namely, $12 per consumer per year plus $24 per horse-power, plus 3 cents per kw-hour for energy used, with a discount of 50 per cent on all in excess of $100 per month, and 5 per cent additional for prompt payment. At Dayton, Ohio, the public garage rate is $4 per kilowatt of demand; up to and including 110 hours' use, 4.2 cents per kw-hour, rate decreasing with increased use; 240 hours and above, 3 cents; with intermediate rates. Private garages, the minimum monthly charge is $5, with rheostat or rectifier, and the rate is 6.6 cents up to 100 kw-hours; 6.35 cents for 101 to 285 kw-hours, and 6.15 cents for 286 to 715 kw-hours, with a 5 per cent discount. Philadelphia, Pa., has three classes of rates for public garages. One has a minimum of $5 per charging set per month, and a 6-cent rate, customer agreeing to stay off between 4 p. m. and 7 p. m. from Oct. 15 to March 15. Another scale is $3 monthly minimum up to and including 3 hp and $1 per horse-power for each additional; with a rate of 10 cents, subject to a varying discount from 10 per cent at two hours' use to 45 per cent at eight hours. The third rate is the wholesale power on 11 hp and over with a load factor of two hours per day; minimum, $4.57 per kilowatt per month; rates varying from 9 cents net at two hours' use to 3⅜ cents at 10 hours. The private owner can come in under the first two rates or in the case of residences using lights, there can be a joint charge under the contract which provides for a minimum of $1 per month and a rate of 10 cents, subject to a scale of discounts; all bills between $10 and $15, such a discount as will make the net bill $10, and upon all bills of $15 and over per month, a discount of 33⅓ per cent if paid within 10 days.

It is hardly necessary to pursue this subject further, although other variations and interesting methods could be cited. Many of the rates are obviously on such a basis as to encourage automobile use; some would seem to be in the nature of restriction and discouragement.

RATES CHARGED BY GARAGES.

One of the most interesting inquiries made is that as to the rates charged by garages to their electrical customers. There is not a great deal of information in reply to that question, but some of it is very significant. In Denver, it is stated to be $30 per month for charging, cleaning and delivering. At Washington, D. C., "the regular garage rate is $35 per month. This

includes the washing, cleaning, oiling, charging, and the delivery of the car in the morning and calling for it in the evening." At Savannah, Ga., it is $25 per month for cleaning and charging. In Chicago it is $30 to $32 for equivalent service. At Rockford, Ill., garages are charged 4 cents for current and make it 6 cents to their customers. At Peoria, Ill., the rate to garages averages 5 cents and they charge 15 cents. At Paxton, Ill., they charge $4 to $5 a week for inclusive service, and at Crawfordsville, Ind., the rate is from $12 to $15 per month; while at Richmond, Ind., it is $20. The rate at Des Moines, Ia., is not given, but it is "usually a flat rate per month, which includes one charge per day, storage, and any small repairs." In New Orleans "different garages charge different rates according to the size and use of the car." In Baltimore the rate is $1 per day per machine, and this rate is quoted at other places without explanation as to whether it includes more than current. Such a rate for current alone would be prohibitive in a great many instances. Boston, Mass., reports a rate of "7 cents to 10 cents per kw-hour for energy, and about $35 per month for storage, washing, polishing, minor repairs and charging." The garages ought to do very well on such a basis. At Springfield, Mass., the garages get energy for 3 cents and charge 6 cents. At Detroit, Mich., the garage rate is $30 per month for pleasure vehicles. At Duluth, Minn., the garage rate is $20 per month, and at Minneapolis it is $35, including care and delivery, while at St. Paul it is $30 per month for a car of 30 cells, including calling for car and delivery, housing and charging. Several returns quote a rate of 75 cents, or $1 per cell, for charging, per month. At St. Louis the garage rate for ordinary coupés and stanhopes is $35 per month for charging, washing, oiling, calling, delivery and inspection. For large broughams it is $40. In Kansas City, Mo., the rate is $30 to $35 per month. At Atlantic City, N. J., a flat rate is charged averaging about $30 per month, and it is the same at Lakewood, N. J. In Brooklyn, N. Y., the garage rate is about $15 per month for charging. At Niagara Falls, N. Y., the garage rate is $25, including delivery, while at Buffalo it is $30. In New York City, the public garage rate for washing, oiling and charging per month is stated to be for runabouts, $32.50; for pleasure vehicles, $55; for business wagons, $45; for 2-ton truck, $50; 3-ton truck, $55; 4 tons and upward, $60. These correspond closely to the rates also of the New York Transportation Company. The garage rate at Rochester, N. Y., is 75 cents per charge, or $25 per month for charging, washing, calling for car and delivery. At Cincinnati, Ohio, the costs of charging, storage, cleaning and minor repairs are "generally lumped in a flat rate of about $20 per month." At Youngstown, Ohio, the rate at garages is 75 cents per charge, all being small cars. At Harrisburg, Pa., the garage rate is $25 per month inclusive of charging, daily washing and one delivery; while at Johnstown, Pa., the garage rate is 20 cents per kw-hour, which might mean anything, the company rate being 6 cents net. In Philadelphia, Pa., the garage rate for energy varies from 6 cents to 10 cents. "Where machines are stored, charged, etc., the cost of energy is contained in a flat total charge per month." At Portland, Ore., the garage rate is $25 per month for charging and cleaning, while Ponce, Porto Rico, reports a garage charge of 3 cents per mile run by the car. In Salt Lake City the inclusive rate for charging, cleaning, etc., and one delivery per day is $25 per month. At Toledo, Ohio, one garage rate for charging, washing and delivering a coupé is $22.50 per month. "It is obvious that too frequent washing of a vehicle is hard on the finish." In Cleveland, Ohio, public garage "boarding" rates are quoted at $25 per month, including two deliveries a day. Some garages are wise enough to grade their rates as described in the April 22 issue of this journal. In New Jersey a rate of $25 per month seems to prevail. In Pittsburgh, Pa., garages charge $6 per week. "This includes washing, charging, general care of machine, also delivery of car to customer and calling for same."

USE OF AUTOMOBILES BY CENTRAL STATIONS.

The data as to electric automobiles in use by central stations are scarce and would be discouraging if it were not for the new interest shown in the subject. A great many central-station officials have gasoline cars for private use or for managerial service, but very few of them have electrics, though why they should not patronize the form of power on which their business itself depends is not known and is hardly explainable. Some of them think it amusing to point out the gas companies that use electricity in their offices or works, but this seems analogous. A number of central stations have gasoline automobiles for general work, but it is hoped that when new ones are bought, they will be electrics. The indications are that they will. Some objections are made as to cost, though electrical automobile manufacturers contend that they can easily "meet the market" in competition with gasolines.

The Washington, D. C., company reports that it uses 1 electric; the Comonwealth Edison of Chicago has 1 electric runabout, 15 trucks of 1½ tons capacity and 1 5-ton truck. Rockford, Ill., has a 24-cell runabout; Pontiac, Ill., the same. Des Moines, Ia., has a 2000-lb. truck and is increasing its service. Osceola, Ia., has 1 machine, and Van Horne, Ia., 1. Boston, Mass., reports 3 1000-lb. trucks and 1 2000-lb. delivery wagon; Brockton, Mass., has a runabout; Newton, Mass., has a 1-ton truck; Plymouth, Mass., has a runabout; Salem, Mass., has a 3-hp machine. Battle Creek, Mich., reports 1 machine, and Detroit, 2 runabouts. St. Paul, Minn., has a machine of 5 hp, but Minneapolis reports it has none. St. Louis, Mo., has 6 pleasure or office vehicles and 4 trucks. Atlantic City, N. J., has a runabout and a 2000-lb. truck. The Edison Brooklyn, N. Y., company has a 2000-lb. truck and a Victoria phæton. Buffalo, N. Y., has a light delivery wagon of 400-lb. capacity. The New York Edison Company reports 12 passenger vehicles and has recently added 2 new landaulettes; 18 delivery wagons of 1000-lb. capacity; 18 of 2000-lb. capacity; 1 5000-lb. truck, 2 of 6000 lb. and 5 of 10,000 lb., making a total of 58 machines in service. The United Electric Light & Power Company of New York also reports 4 electric delivery wagons, 2 2-ton trucks, 1 5-ton truck, 1 runabout and 2 surreys. At Rochester, N. Y., there are in use a truck and 4 runabouts. Schenectady, N. Y., has a 1000-lb. delivery wagon and a 2-ton truck. Syracuse, N. Y., has a runabout. Harrisburg, Pa., has 2 runabouts. Philadelphia, Pa., has 3 runabouts, 11 1-ton trucks, 3 5-ton trucks and 1 of 1000 lb.—10 machines in all. Providence, R. I., has 4 machines of 3 hp each. Electric wagons have also been put in service recently by the New York & Queens Electric Light Company and by the Chattanooga Electric Company. There are two or three thousand electric wagons and trucks in use in the country, but not many of them, it will be seen, in the service of the companies, where as large a field as anywhere else exists for missionary effort.

SPECIAL AUTOMOBILE OFFICIALS.

Very few of the companies reporting have special officials whose duty it is either to "drum up trade" in electric automobiles or attend to the technical side of the subject for the public. In many instances, this class of business is in the hands of the power department. St. Louis, Mo., has a regular official "superintendent of the auto department" in charge of garage, salesrooms and battery-rooms. Galveston, Tex., has an "agent." At Salt Lake City "power representative handles inquiries." Boston, Mass., has two special automobile officials, one for its own cars, and a "special electric-vehicle agent who promotes the sale of vehicles and all current to garages." At Salem, Mass., it is the duty of one official "to interest prospective customers and make inspection of the outfit at stated intervals." At Chicago, the Commonwealth Edison Company has a special agent to look after this business, and the battery expert for its own vehicles "gives customers advice on request." At Rochester, N. Y., the company has established an electric-vehicle department in charge of a competent engineer to look after all vehicles charged from its circuits. It has also taken an agency for vehicles, to sell at a price including all maintenance for one year. The New York Edison Company, outside its own vehicle staff, has an automobile engineer to promote this branch and represent the company in all automobile relationships with the public. In some places, the lighting superintendent or the electrical inspector "takes care of this branch in case of trouble."

LETTERS ON PRACTICAL SUBJECTS

AN ELECTRICALLY DRIVEN BLAST FAN.

A brief account of a recent installation of a No. 7 Sturtevant blast fan in a large blacksmith shop may be of interest to some readers. The fan is suspended inverted from two I-beams 18 ft. above the ground, and supplies air blast to 15 oil furnaces having a total of 23 burners. The pressure is 9.6 oz. in the main pipe and 4 oz. 100 ft. away. The motive power is a shunt-wound enclosed motor, rated at 15 hp, four-pole, 230 volts, 58 amp, 850 r.p.m., and belted to a countershaft so as to speed up the fan to 2000 r.p.m.

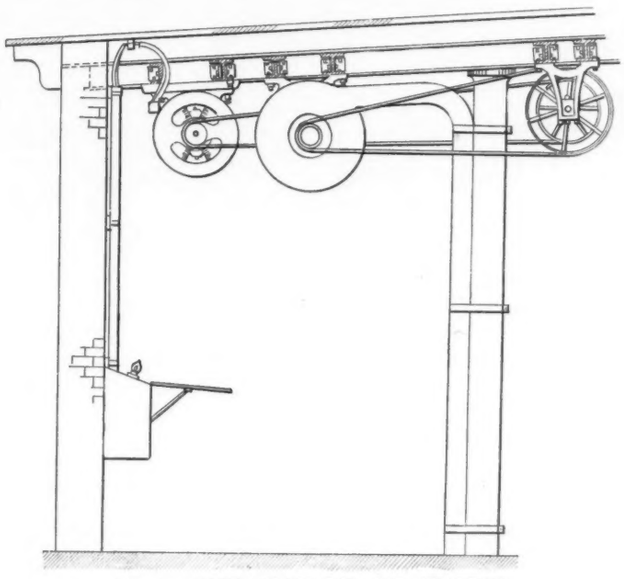


FIG. 1.—MOTOR, BLAST FAN AND SHAFTING.

The motor is suspended from two I-beams and has two heavy slotted rails. As the weight is 1500 lb., the matter of a safe suspension could not be overlooked. Four ¾-in. x 4-in. hand made bolts hold each rail in place. Each bolt has a head 1½ in. square by 1 in. thick, and is provided with two heavy nuts, a washer and a cotter 1½ in. long. The rail bolts also were specially made, being ¾ in. diameter by 4 in. long, with two nuts, cotter and washer. The lock nuts prevent the bolts loosening from the constant vibration of the motor, while the cotters allow the motor to be dropped from the rails about ⅛ in. and shifted backward to tighten the belt without any fear of the nuts dropping to the ground. All this is done without removing the cotters. The double 6-in. belt on this motor has been tightened in 10 minutes without stopping the fan. The rails are placed so that one belt screw is in front of the motor at the pulley end, and the other is behind the motor at the commutator end, thus only a wrench is needed to make a shift in either direction. The motor is placed in relation to the fan so that the top side of the belt sags, thus closing around the pulleys the more it stretches. The wiring is all slow-burning weatherproof, which does not readily collect dust like rubber covered.

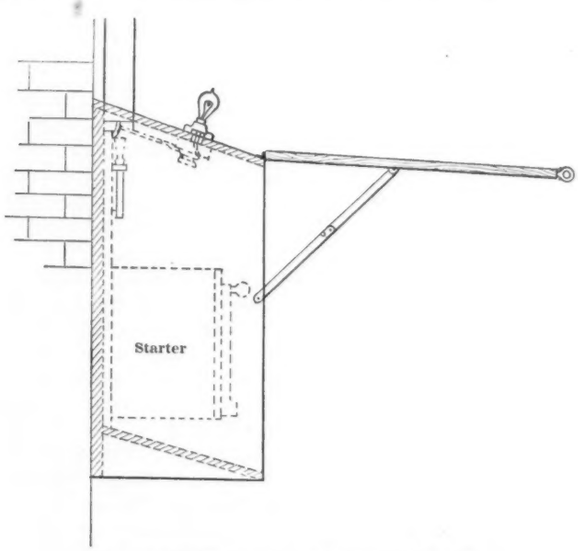


FIG. 2.—STARTING BOX ENCLOSED IN CABINET.

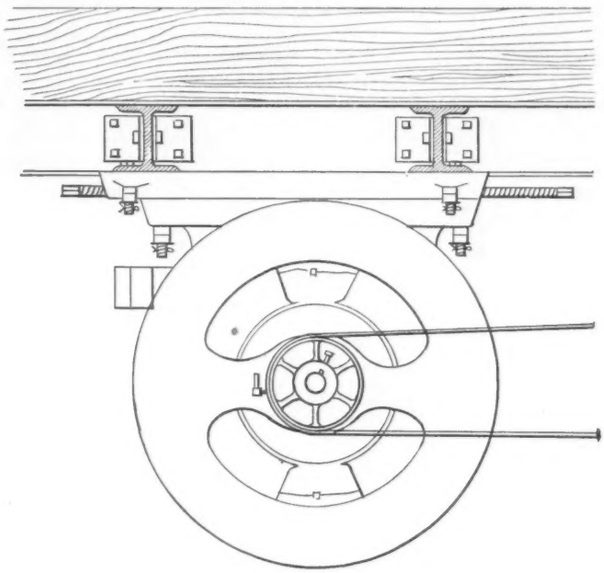


FIG. 3.—DETAIL OF SUSPENSION.

Open wiring is employed overhead, but down the side wall the wiring is enclosed in flexduct and run through plain iron pipes. The pipe is carried up to the ceiling to protect the lines from any ladders or long bars that might be leaned against the wall. A 4-cp lamp is connected across the feed line to the switch and indicates when the circuit is alive or dead. A single pole cut-out and fuse are provided for the pilot lamp. The starting apparatus is mounted on a slate panel and enclosed by a dust tight cabinet having the whole front made as a door to open upward and held open by a hinge. A door made this way cannot be left open usually, without being in the way of something, and when down it is completely shut. The top section is made slanting to shed the dust, and the bottom section is made slanting to prevent tools being placed inside so as to prevent the operation of the starter or overload release. When installed, the air pressure was not sufficient with the fan going at 1800 r.p.m., driven by a 10-hp motor. The proper changes were determined as follows, which may be found of value to others.

The previous pressure was 8 oz. in the main pipe, and the motor current was 40 amp at steady load. It was proposed to raise the pressure to 9.6 oz., making the ratio of increase 1 to 1.2. The increased amperes equals $1.2^2 \times 40 = 57.6$ amp. Thus the 10-hp motor had to be replaced by a 15-hp machine rated at 58 amp. The square root of $1.2 =$ close to 1.1, giving the ratio of increase speed required at the fan to raise the pressure to 9.6 oz., which meant a change from 1800 r.p.m. to 2000 r.p.m. This was easiest made by increasing the speed of the countershaft 1.1 times the previous speed by decreasing the size of the motor-driven pulley.

POUGHKEEPSIE, N. Y. H. S. RICH.

TROLLEY-WIRING A PUBLIC SQUARE.

There are a few criticisms which may be made on the layout shown by James Francis in the last issue. The old central ring plan is employed; that is, a bull ring in the center from which all pull-off wires run. For ease of construction and stability the scheme answers very well; but for appearance and

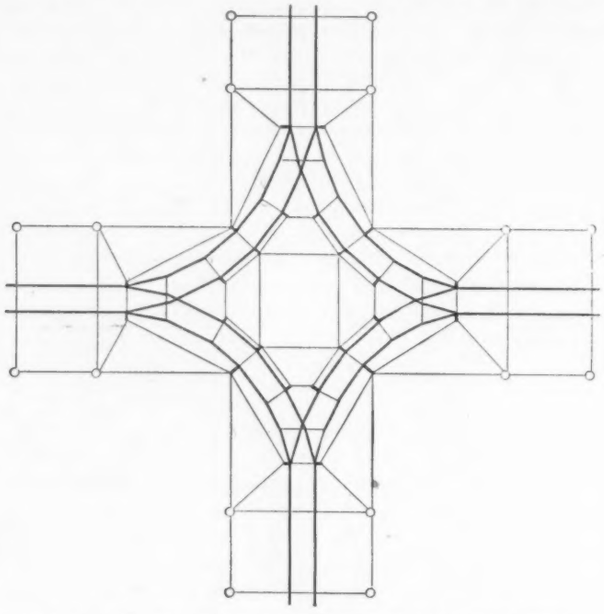


FIG. 1.—PULL-OFF WIRES AT RIGHT ANGLES TO TROLLEY WIRES.

wear, it is not as good as the plan shown herewith. For example, some of the pull-off wires form very acute angles with the trolley and a trolley pole coming off the wire on the curve would be very apt to become entangled. By not pulling more at right angles to the curve, more strain is thrown on the trolley, and so there is a tendency to throw slack in the wire. From the sketch it will be noted that all pull-off wires are at right angles to the trolley. Should a hanger break, the other curves are not affected, the curves being supported by the spans and

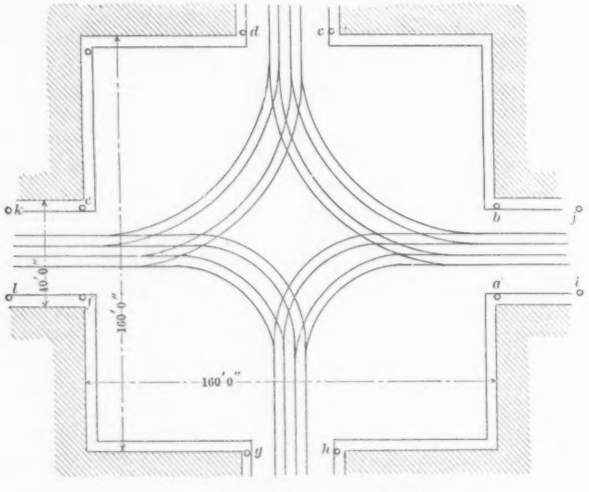


FIG. 2.—SQUARE TO BE WIRED.

the girdling wires outside. The strain of the trolley wire in the curves is taken up by the four central pull-offs, and thus no central support is needed.

Chicago, Ill. Millard Gilmore.

The last issue contained a description of the wiring layout for supporting trolley lines in a public square (Fig. 2), the sides of which were each 160 ft. long, with intersecting streets 40 ft. wide. The writer has had occasion to lay out similar installations, and offers a plan which he has used with much success in keeping trolley special work in line, reducing wear on service wire to a minimum and as nearly as possible eliminating accidents due to trolley wheels leaving the wire and damaging overhead construction. Three requirements are to be considered: (1) proper location of trolley wire to prevent

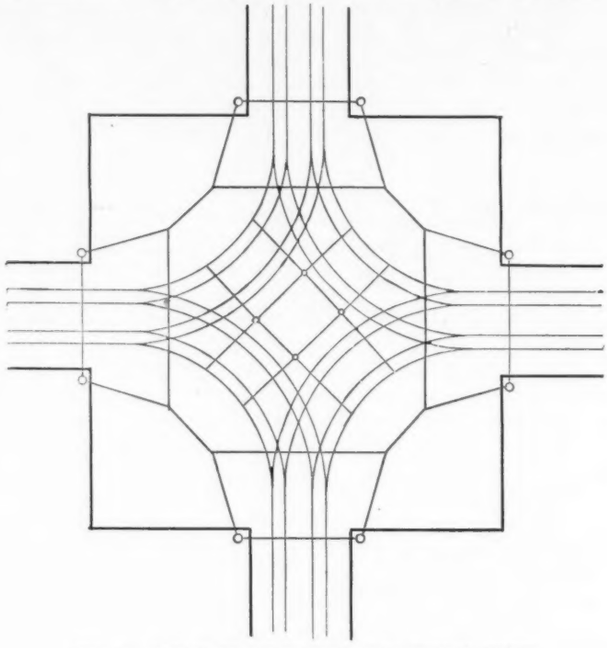


FIG. 3.—ARRANGEMENT OF SPAN AND STRAIN WIRES.

undue wear, (2) pull-off and span wires to pull from and across trolley at right angles at the intersecting points, (3) pull-offs to be "strapped" together with galvanized iron wire of suitable size to prevent same from dropping to street should an ear become detached. In the layout in question, the tension on the four double curves can be equalized, each being made to support the other, thereby relieving somewhat the strain on poles. The guys to poles as shown maintain the trolley at its proper height from track, and also supply additional strength and stiffness. Fig. 3 shows the proposed layout; the shaded lines represent trolley wires and light lines the arrangement of guys and pull-offs. Wood strain insulators should be used in connection with double and single curve hangers in order to give proper distance between trolley wire and wire used in tying pull-offs together.

Chattanooga, Tenn. J. Clint. Donald.

TELEPHONE LUBRICATION TESTS.

The writer has had for a long time an idea that the telephone receiver could be made to tell some very interesting stories about what was going on in the lubricants which might be interposed between two rubbing or bearing surfaces. This is, however, a matter which may be very easily tested and by attaching a telephone receiver and a cell of dry battery to a pair of shaft hangers, as shown by Fig. 1, considerable light can be obtained regarding the behavior of the bearings under various stages of lubrication. In this experiment the cell *a*, receiver *d*, and two journal bearings are simply connected in series, and the observer listens to whatever sounds may be heard in the receiver. In this case the instruments are affected by whatever takes place inside both of the bearings, and if the lubricant perfectly insulates the shaft from either or both bearings, no sound will be heard in the receiver. Likewise silence will be the result if the oil-film does not occasionally at least separate the shaft from one of the bearings. That is, if the bearing is running solid, metal to metal, with no oil between, then there will be a solid connection between the two and no sound will be heard in the receiver. It was soon found that having two bearings in circuit at the same time was a great disadvantage,

and accordingly means were sought for some way of isolating them so they could be tested separately. To this end connections were finally made, as shown by Fig. 2, the collar *a* being substituted for one of the bearings, the other connections remaining the same. Not caring to trust to a brush for connecting directly with the shaft, the device *a* was arranged, as shown in detail by Fig. 3. The disk *a* was cut from thin sheet metal. Tin will answer for short experiments—while the tank shown by the succeeding engraving may be made from a portion of a tin can. It is better to use thin sheet copper for these contacts, if they are to be used for any considerable length of time, because the solution used in the tank attacks the tin very readily and then begins on the plate underneath the tin. If copper is used, the contacts may be made permanent parts of the arrangement, and the bearings tested day by day with the

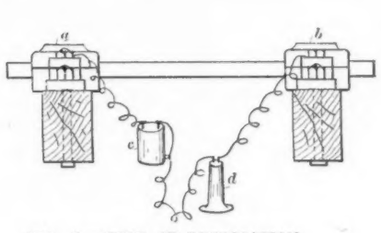


FIG. 1.—TEST OF LUBRICATION.

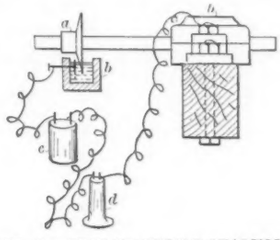


FIG. 2.—TEST OF SINGLE BEARING.

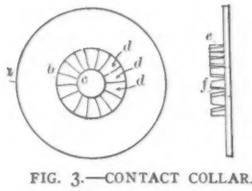


FIG. 3.—CONTACT COLLAR.

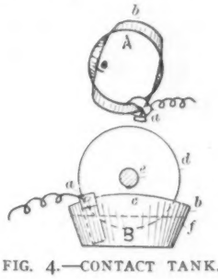


FIG. 4.—CONTACT TANK.

probability of hearing some very interesting things concerning lubrication within the bearings thus electrically connected. The contact shown by Fig. 3 may be made very readily by describing the circle *a* with a pair of dividers, making the circle as large as will comfortably go into the tank shown by Fig. 4. Next describe the circle *b*, Fig. 3, equal to the diameter of the shaft upon which the collar is to be placed. Describe another and smaller circle, *c*, and cut the metal along this circle, leaving a hole. Next cut the radial slashes *d, d, d,* etc., accurately to the circle *b*, and turn these pieces of metal outward, as shown at *e* and *f*. This may be readily effected by placing the disk in a vise with the jaws even with line *b*, then bend one of the sections, *d, d,* down to the vise jaw, then revolve the disk in the vise and bend another section. Continue until all have been bent out at right angles, as shown at *e, f*. Next, slide the collar upon the shaft, as shown at *a*, Fig. 2, and bind the turned-out sections, *e, f*, Fig. 3, firmly against the shaft by means of a strip of adhesive tape wound tightly around the shaft over the sections. The collar should be trued up as accurately as convenient in order that it may pass through the liquid in the tank with as little agitation as possible. The tank, Fig. 4, may be made of copper, or it may consist of a part of a tin can. The writer has made several of these vessels from the lower portion of molasses cans, which are not as prone to rust as tomato cans. In fact, a good tank for permanent use can be made from a tin can as above described, provided that the metal be well coated with paraffin or asphaltum, and that the copper contact plate, *a*, be clamped to the side of the tank, as shown by sketches *a* and *b*. The tank *b* is now filled with a saturated solution of copper sulphate and secured underneath shaft *e* in such a manner that the disk *d* will dip into the solution in the tank. The solution had better be kept concentrated by means of crystals of copper sulphate in the bottom of the tank. As long as such crystals are there, and the solution does not fall below the bottom of disk *d*, the electrical connection through the solution will be first class and very continuous. The writer has not revolved a contact of this kind more than 500 r.p.m., but the receiver has not been able to detect any breaks in contact continuity when tests were made at the speed mentioned. Some very interesting facts have been observed when a tin collar was in use in a tin tank. Chemical action commenced immediately between the solution, the disk and the tank, the latter being corroded until the tin was removed, then a deposit of copper appeared on portions of the tank adjacent to the plate *a*, which in this instance was brass instead of copper. The most interesting action was observed at the disk, which was quickly blackened where it dipped into the solution, then a loose copper deposit soon appeared along the edge of the disk. Flakes of metallic copper also soon appeared upon the surface of the solution, and continued to float there until the surface of the solution looked as though it had been thickly covered with fragments of gold leaf. Before detailing further observations in the directions of bearings, it may be in order to describe some experiments which were made before the running bearings had been connected. Upon becoming interested in the possible behavior of two metallic surfaces separated by an oil film, in the hope that the telephone receiver might give a clue to the condition of the surfaces and the quality of the oil-film, the writer tried the little experiment illustrated by Fig. 5. Here a bit of smooth metal, *a*, was soldered to a wire which in turn was connected to the receiver *d*, in series with dry cell *c*, and the wire was then soldered to the bit of tin *e*, which was punched out and formed to the shape of a watch glass by a single stroke of a hammer. The tin was placed upon solid end-wood and a hollow punch about 1 in. in diameter concaved the small disk to exactly the right shape by sinking the edges of the tin into the hard wood before the hollow punch had passed through the tin plate. A spot of oil, *b*, was placed upon the plate *a* and disk *e* lowered upon the oil and rubbed about by the finger while the receiver *d* was held to the ear of the experimenter. Ordinary heavy tin was used in the experiment, and it was quickly discovered that the surfaces were not smooth enough. With ordinary engine oil at *b* the receiver never gave a sound as *e* was rubbed back and forth. When castor lubricating oil was substituted for the engine oil, intermittent noise was heard in the receiver as disk *e* was rubbed

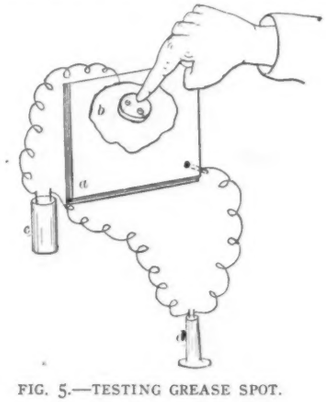


FIG. 5.—TESTING GREASE SPOT.

back and forth. It became apparent almost instantly that the metal surfaces between which the oil was interposed were not smooth enough. Accordingly both *a* and *e* were treated with fine emery cloth and rubbed until a quite smooth surface was obtained on each. Then the emery was removed and the rubbing continued with other and finer abrading material until a fairly smooth and even surface had been obtained on both *a* and *e*. With the smooth surfaces it was quickly found that a different sound was given when sperm oil was between the rubbing metals from that given when crude oil was used. In order to distinguish more readily between the sounds made when different oils were between the plates, several disks were smoothed and soldered to flexible wires, as shown by *a, b, c, d*, etc., Fig. 6. The wires from the several disks were all soldered

together at *e*, and the free end of wire *f* connected to the battery. By means of this arrangement, several oils of various kinds may be placed upon the smooth plate (a surface plate is much better than a sheet of tin) at the same time and tested one after the other by bringing down into each oil-spot its respective disk. In this way the test of each oil may be repeated at will, and may be compared with that of each other sample of oil on the sheet as often as desired. Even with smoothed-up

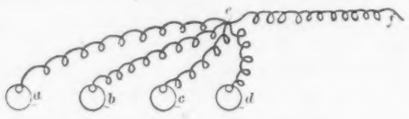


FIG. 6.—MULTIPLE TEST OF DISKS.

pieces of tin for surface plate and test disks, the writer was able to distinguish readily between sperm oil and "harvester" oil, black oil and many other lubricants. The method here described reveals many interesting and valuable points to the investigator, be he engineer, electrician or manager. With a wire connected by liquid contact with the line shaft, branch wires may be run to each bearing upon that shaft and brought to a switchboard where each wire may be plugged or switched at will into the telephone circuit, and the behavior of the lubricant and the condition of each bearing may be studied. The lubrication in any particular journal will be found to give a different sound in the receiver from any other journal on that shaft, and the condition of the bearing, from the time it was oiled to the time it is oiled again, becomes plainly apparent by listening at the receiver from time to time. When a bearing is going dry, it gives a never failing warning to the receiver which, if needed by the attendant, would result in the dryness being detected and relieved before it did damage to the soft metal lining or to the shaft bearing. There is, in the above described method of acquiring information, one time when the observer will fail completely and regularly. That is when graphite has been used as, or in, the lubricant. When the journal bearing has become filled with or coated with graphite, the insulating qualities of the oil have disappeared and there will be a dead ground between the shaft and the bearing.

Willoughby, Ohio. James F. Hobart.

LOCATING AND CURING TELEPHONE EVILS.

The following experience is not given as being new or novel, for doubtless in the experience of telephone experts the troubles noted have been met with many times and the remedies have been used as frequently. But to the laymen in telephone handling, a knowledge of some of the ills and their remedies and how to find the one and apply the other certainly comes in very acceptably, and for this purpose the experience is given, although it may be ancient history to the expert telephone electrician. A certain telephone line was fitted with three series instruments and extended two miles or more from the central station into the country. Whenever the weather was damp trouble was experienced by two of the subscribers both in ringing and in talking with central, though they had no trouble whatever in ringing or in talking with each other. The line was strange to the management, and after tracing it out a sketch was made which is reproduced as Fig. 1 herewith, which shows plainly the cause of the trouble. The instrument A, instead of being in series with the other instruments, is bridged across the line, short-circuiting the central station and rendering that usually necessary proposition useless to all but the first station, *A*, which was at all times in perfect touch with central, also with the other two stations. It had become the custom of the subscribers at *B* and *C* to call up *A* when they wanted central, and then have that station call central and repeat the conversation both to and from the subscriber. This was necessary in very damp weather only, for when the insulation was good, speech could be fairly heard in all the receivers at *B*, *C* and central. A lineman was sent out with instructions to cut instrument *A* into the line in series with the other instruments. The man departed, but after trouble hunting again the severed instruments were found to be connected as shown by Fig. 2. It is now evident that instruments *A* and *B* are in touch with central, while instrument *C* is still isolated from central and from instrument *A*.

When *C* wishes to call central, he must now call station *B*, who in turn rings up central, or who can ring station *A* if *C* desires to talk with that one. Instrument *B* has now become a substation to do the work for central—or to

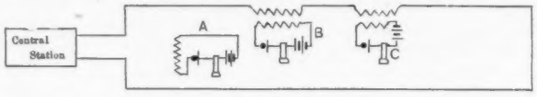


FIG. 1—DEFECTIVE SERIES TELEPHONE LINE.

do that portion which relates to calling either of the instruments on the party line. The next trip of the lineman resulted in all the instruments, *A*, *B* and *C*, being cut into the upper side of the line, as indicated in the diagrams. But then a new source of trouble developed and the line became noisy and picked up considerable cross talk from toll lines upon the same poles. Another trip by the lineman and the instrument *A* was cut into the lower wire, leaving the instruments *B* and *C* in the upper wire, as shown by Fig. 1. This resulted in very nearly

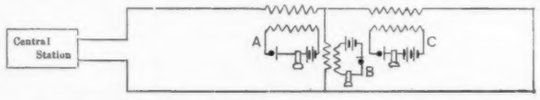


FIG. 2.—SERIES TELEPHONE LINE AFTER CHANGE.

balancing the work on the line, and most of the noise disappeared. Finally a transposition was made in the line between *B* and *C*, and it then became one of the best-behaved series lines the writer ever talked over.

Another line which gave considerable trouble by picking up cross-talk from neighboring toll lines was arranged, as shown by Fig. 3. About two miles of line was necessary to reach the house *B*, which was fitted with two instruments, both series connected to the same pair of drops which left the line

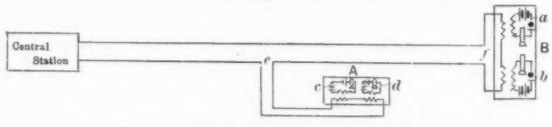


FIG. 3.—TELEPHONE TROUBLED WITH CROSS-TALK.

at *f*. Another house, *A*, about midway of the line, was fitted with another pair of instruments, which were likewise series-connected to the single pair of drops, *e*.

It was found to be very hard work to talk over this line when the neighboring toll lines were very busy. When toll-talk was light, conversation could be carried on quite comfortably over the line, excepting that it was quite noisy. The first attempt at improving matters was by disconnecting instrument *d*, Fig. 3, and connecting it into the opposite side of

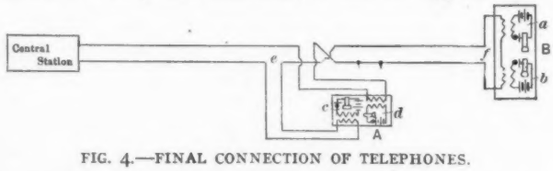


FIG. 4.—FINAL CONNECTION OF TELEPHONES.

the line through the new pair of drops *e* which were cut in for that purpose. This operation, as shown by Fig. 4, resulted in much better conditions in the line, much of the noise being eliminated, but the cross-talk still continued to be heard as badly as ever. Balancing the line, or the instruments in the line had proved beneficial, but it was evident that something was needed to stop the cross-talk, therefore a transposition was made in the line at *h*, and being about in the middle of the portion affected by toll-line induction, it proved to be a cure.

New York. James Francis.

QUESTIONS AND ANSWERS

In calibrating commutator-type meters on light road, we usually succeed in getting the meter up to speed; but find it impossible to keep it there very long. Can this be remedied? T. I. S.

Ordinarily it is best to adjust the meter to normal conditions by having the brushes just right, even if it is necessary to leave the meter a trifle slow on light load. If the brush tension is excessive, friction causes trouble and if it is too slight, sparking results at full load, causing roughness on the commutator. The general result will be that the meter will not operate on light load and will invariably be slow on full load.

Why does a shunt-wound motor increase in speed with decrease in field strength or with change of brush setting? F. W.

You will find these questions fully covered in almost all works on electricity. When the field strength of a shunt-wound motor is decreased the counter e.m.f. is decreased and a sudden increase in armature current results. This produces more torque than is necessary to carry the load so the motor speeds up. The speed of a shunt-wound motor is a minimum when the brushes have zero lead. Any movement of the brushes from this setting will increase the speed because the counter e m.f. is thereby reduced.

When should dry cells be discarded? W. E.

The available energy from a dry cell decreases as soon as it is put in service, but just so long as a cell contributes e.m.f. to the circuit in which the current exists, there is no reason why it should be discarded. If the potential drops it will be necessary to increase the number of cells so as to maintain the required e.m.f. On the service conditions will depend the point at which the cells should be removed. Cells should not be left in circuit until their e.m.f. is nil, since they then act as resistances; nor should the number added to the series to increase the e.m.f. be very large. Best results are obtained by discarding the cells after the e.m.f. has dropped below a certain value.

In a railway substation should not the secondary of the transformers be grounded to lessen the life hazard? J. B. B.

In railway substations the negative pole of the rotary is usually directly connected to the negative bus and ground without any switch, so that the secondary of the transformer is permanently grounded through the rotary converter and forms a safeguard in case the high-tension winding of the transformer should break down on the secondary. This arrangement is used in order to simplify the switchboard, the equalizer switch being mounted on or near the rotary and the equalizer bus and negative bus being placed in close proximity to the machines, usually below them in a pit, leaving only the positive single-pole switch and bus to be placed on the switchboard proper. To place another ground on the transformer would be to short-circuit it.

In a medium-sized central station feeding a mixed load what is the best arrangement of busbars to use? H. A.

In the arrangement of busbars, simplicity as far as it is compatible with reliability of supply is essential. With a mixed system this can be obtained by using one set of buses for lighting and another for motor load if the latter is large enough to warrant separate circuits. Each feeder and each machine should be provided with double-throw switches so that they can be connected up to either set of busbars. Means should also be provided for coupling both sets of buses together. In the case of a system in which the lighting load is the greater and where motors may be fed from the same lines by the arrangement of duplicate buses any generator may be used to supply any feeder so that better regulation can be secured, the circuits on which motors form the greater part of the load being isolated from those feeding only lamps. The use of a second set of buses has always been found advisable and invaluable in testing any faulty feeder or machine, as it permits of such work being done during the hours of ordinary supply. The little extra capital involved is offset by increased reliability and efficiency of working.

I am in want of information in regard to the behavior of electrical resistance material under different varying conditions and temperatures. Is there an alloy or metal that has an extremely high positive-resistance temperature coefficient many times that of iron and which is yet a fairly good conductor at ordinary temperature? Are there any metals having a high negative-resistance temperature coefficient and which have fair conductivity at ordinary temperatures? C. F. T.

Among the conducting materials having a negative-resistance temperature coefficient, the most promising ones for commercial purposes are carbon, tetroxide of iron (known as "magnetite") and a mixture of magnetite and chromate of iron. The last named has a higher initial resistance than magnetite; but is equally conductive at high temperatures. When magnetite is at a red heat, its resistance is about 1 per cent of that at ordinary temperatures. Of the materials exhibiting a positive-resistance temperature coefficient there are many; but iron is the best that has come to our notice.

How much electricity is now being generated annually in the United States by water-power? What is the largest amount of power being developed in any one locality? How far is electricity from Niagara Falls transmitted? J. A. L.

The approximate water-power development in the United States is 3,500,000 hp. Of this 1,600,000 hp is used to generate electricity in lighting and railway plants and 1,900,000 is utilized by industrial concerns. Much of the latter is converted into electrical energy; but how large a percentage it would be difficult to say. The combined output of all the stations at Niagara Falls (N. Y. and Ontario) is approximately 300,000 hp. The public utility companies in New York City generate about 500,000 hp by steam. Electrical energy from Niagara Falls is transmitted as far as Syracuse, N. Y., a distance of 160 miles.

If the name plate is missing from an induction motor frame having three terminals on the connection board, how may it be ascertained whether it is a three-phase motor or a single-phase motor that is started by a split-phase box exterior to the motor? Can a motor of the latter type be operated as a three-phase motor by connecting the lines direct to the terminal board and cutting out the split-phase box? G. J. R.

It would be rather difficult for you to determine whether the motor in question is a three-phase or a single-phase machine, since many of the single-phase motors on the market are in reality three-phase machines. If the motor has a clutch on the rotor shaft it is a single-phase machine. The best method to pursue in ascertaining the identity of the motor is to have someone who is thoroughly conversant with the motors on the market look at it, and determine from its appearance whose make it is; you may then take the serial number stamped on the machine, and address the manufacturers, who will give you the necessary information. If, as intimated above, the motor is a three-phase machine operated as a single-phase motor, it can, of course, be run as a three-phase machine by connecting the lines as suggested.

Two single-phase transformers, 2200-100 volts, are connected, one to phase "A" and the other to phase "B" of a 2200-volt, two-phase system. The secondary coils are wound for 100 volts each and are connected in series giving as a resultant a single e.m.f. equal to $100 \times \sqrt{2}$, or 141.4 volts. The current rating of the secondary coil of each transformer is 10 amp, and the current rating of the series coil is also 10 amp. From this it is seen that the joint output of the two transformers feeding the single circuit referred to is less than if they were operated separately on independent circuits. Why is there a reduction in the permissible output? H. M.

The two component secondary e.m.fs. are out of time-phase with each other by 90 deg., while the resultant e.m.f. is ahead of one e.m.f. by 45 time-degrees and behind the other by an equal amount. With a non-inductive load the secondary current would be in time-phase with the resultant e.m.f. and hence 45 time-degrees out of phase with each of the other e.m.fs. It may be said, therefore, that even with a non-inductive load, each transformer acts as though the power factor were only 70.7 per cent. That is to say, the permissible output of the two transformers connected as indicated is only 70.7 per cent of the total output when the transformers are used separately. However, by using a third wire at the junction point between the two transformers and connecting the receivers between this wire and the outer two, the full rated output can be obtained from each transformer.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Wood-Burning Central-Station Plant.

Albuquerque, N. M., a city of some 20,000 population, up to two seasons ago was operating a steam-driven electric light plant with somewhat inadequate machinery, and with such poor financial results that upon a reorganization about that time it was decided that something must be done to decrease operating expenses. The entire plant was thereupon removed to a new steel-frame, ironclad building erected within the yard enclosure of the American Lumber Company.

The American Lumber Company's plant occupies a yard enclosure of about 1 sq. mile, northeast of the city, and its annual lumber cut is enormous. It has two power plants with slab and sawdust-burning equipments, but the excess of waste cuttings is very large, and an arrangement was entered into by which the electric lighting company utilizes this additional waste.

The lighting plant is situated some 400 ft. from any portion of the yards or wood-working buildings, and consists of three banks of boilers, wood-burning, with automatic feeds from a continuous chain conveyor, depositing the surplus in bins beyond the power plant. The tram carrying conveyor is about 500 ft. from the sawmill, and together with a 1000-ft. sawdust blowpipe from the wood-working buildings, is led direct to a digester driven by two induction motors. In this digester, which is situated some 30 ft. from the boiler house, all the slabs are chopped to a uniform size, mixed with sawdust, and led by conveyor over the boilers to valved traps controlled by the stoker. The chain arrangement through the boiler-room is so arranged that in event of the shutting down temporarily, for any reason, of the main conveyor from the woodworkers and sawmill, the return chain will carry back chopped wood refuse from the bins beyond the boiler-room and feed the boilers in that manner.

The engine equipment is completely modern, consisting of three-phase, slow-speed alternators, which, however, are belt driven so as to utilize the compound engines from the old plant. Two belted railway generators of 100 kw each, with separate switchboard, supply an electric railway of some 12 miles of single track. The railway has given good financial returns, in spite of the fact that the usual small-town railway is not self-supporting.

The entire lighting of the town is supplied from this plant, the old lighting plant at present being used as a booster substation for regulating the feeder voltage. No reserve is kept at the old plant, but an attendant is maintained there to attend to the voltage regulation, all regulators being under his control. The machine for series-arc lighting is also situated at the substation.

Besides supplying the city, some 200 arcs and some 3000 incandescent lamps are supplied to the mills and yards of the American Lumber Company. Some idea of the extent of this company may be gained from the fact that of three lumber storage yards within the main enclosure, the largest has an area for 20-ft. to 30-ft. piles of over 20 acres.

The main power station is constructed entirely of noncombustible materials, and has, in addition, a complete standpipe and hose equipment, together with sand pails and chemical extinguishers. The water is furnished at present from the private system of the American Lumber Company, comprising some four miles of mains, mostly 6-in. and 8-in., the pump supply being from a detached brick, metal-roof pumping station; the only source of steam supply for the pumps at present is from the brick boiler house of the sawmill through 150 ft. of underground steam pipe. An auxiliary feed for pump supply is contemplated to operate two 75-hp, 2300-volt induction motors driving centrifugal fire pumps located in the above fireproof pumping station.

The entire arrangement is unique and the development of the American Lumber Company is sufficient to warrant the expectation that the plant will be of sufficient capacity for Albuquerque for the next 10 years at least.

Maintenance of Tungsten Lamps at Rochester, N. Y.

In line with its policy of giving its patrons all the advantages to be derived from the use of more efficient units, the Rochester Railway & Light Company has for many months past placed tungsten lamps at the disposal of its customers for a fixed first cost, after which, if desired, the company will renew the lamp on a maintenance contract. The contract applies only to lamps connected up solidly and permanently on keyless sockets. The prices charged for the lamps are as follows: 25-watt, 70 cents; 40-watt, 90 cents; 60-watt, $1; 100-watt, $1.10; 250-watt, $2.20. The maintenance charge on the 25-, 40-, 60- and 100-watt lamps is 8 cents per lamp per month and for the 250-watt lamp the charge per month is 10 cents.

The energy used is charged for at schedule rates. In order that it might have some basis for costs, the company took the account of the customer and calculated as nearly as possible the average hours' use of installation. In October there was 189 kw of tungstens connected on maintenance apportioned as follows: 77 40-watt lamps; 1176 60-watt lamps; 1104 100-watt lamps, and 59 250-watt lamps. The maintenance cost for the month was $530.67 and the breakage cost $205.90, or a total of $736.57. The energy consumed approximated 35,269 kw-hours and the income from maintenance amounted to $199.08. The cost per kw-hour for maintenance on the assumptions made was 1.52 cents. In November there were 121 40-watt lamps, 1298 60-watt lamps, 1105 100-watt lamps and 109 250-watt lamps connected on maintenance, or about 221 kw. The estimated consumption of energy was 39,260 kw-hours, the cost of maintenance $561.85, breakage $145.14, or a total cost of $706.99 against which was a maintenance charge of $218.34. The cost of maintenance was 1.24 cents per kw-hour on the basis assumed.

Inasmuch as the company has followed the same lines for the past six months, it will be of interest to note that its report for June, 1909, one of the lightest months of the year, shows a large increase on the connected load and an exceptionally large addition in the number of 250-watt lamps installed. The report also shows a very material decrease in the cost per kw-hour. In June there were 27 25-watt lamps, 966 40-watt lamps, 2505 60-watt lamps, 2351 100-watt lamps and 391 250-watt lamps connected on maintenance, or about 523 kw. The estimated consumption of energy was 109,862 kw-hours; the cost of maintenance $801.12; breakage, $182.90, or a total of $984.02, against which was a maintenance charge of $504.17. The cost of maintenance for the month of June per kw-hour was, therefore, $0.004 figured on the same basis.

With improvements in manufacture the cost of maintenance has decreased, and the business is now carried with profit. The records show that the tendency is to keep up the kw-hour consumption, and in many cases to increase it, and the enthusiasm aroused by the company among its patrons is of inestimable value. In order that installations do not suffer from careless treatment and also that the best results may be obtained, an employee of the company inspects each installation regularly, renewing all burned-out and blackened lamps, and also washing and cleaning the shades at regular intervals. In this way the consumer gets the full lighting efficiency, and is impressed with the painstaking care that the company is showing toward giving him the most satisfactory service possible.

Reports on Tungsten Installations.

At the convention of the Ohio Electric Light Association, July 15, a feature of the program was the reports from various companies on experience with tungsten lamp installations. One member reported a large number of such installations in stores, replacing all other illuminants. The only objection he found was that it was rendering the company's multiple-arc lamps scrap.

Mr. W. E. Richards, of Toledo, reported that the tungsten lamp is superseding both Nernst and arc lamps. Mr. E. H. Beil, of Youngstown, said that in some cases the income from large installations had been reduced 40 or 50 per cent, but the general increase in business was more than enough to make up for this. Mr. W. C. Anderson, of Canton, reported having begun the use of 10-volt tungsten lamps, 11 in series, on 110-volt circuits for electric signs. His experience was not sufficiently extended to justify any statement as to their life. His company has put out about 3,000 ordinary multiple tungsten lamps, and has 1,000 more under contract. Results with 250-watt tungstens have been gratifying.

Mr. M. E. Turner said that in Cleveland the lamp companies are making tungsten lamp sales. These companies have arranged for selling these lamps in durg stores. The lamp companies and the central station are working in close harmony. All advertisements of the tungsten lamp read, "Two and one-half times the light for the same money," rather than the same light for less money.

Mr. A. A. Pointer, of Antwerp, Ohio, said that he bought the Antwerp plant last November with 68 consumers. There are now 120 consumers and 400 tungsten lamps.

Mr. J. C. Rothery, of East Liverpool, has a street-lighting contract under which the company agreed to furnish 50-cp carbon-filament lamps. These have been changed to 60-cp tungsten series lamps, which have been in use one year, or about 4,000 hours, and less than six have been renewed. In Chester, W. Va., 35 80-cp series lamps have been in service with two or three renewals since Jan. 1, 1909. These have been competing with two-mantle natural gas arcs, and Mr. Rothery expects on the whole to displace gas lighting with these lamps. As a result of the introduction of tungsten lamps in stores, his company is accumulating a "fine stock" of second-hand multiple arc lamps.

Mr. Henry Schroeder, of the General Electric Company, explained the methods of using the new 11-volt tungsten sign lamps. On alternating-current circuits they can either be connected to a transformer with an 11-volt secondary, or on a compensator. On direct-current circuits they are connected in multiple series. At a rate of 10 cents per kw-hour the tungsten sign lamp costs one-third as much as a carbon sign lamp, and at 5 cents per kw-hour one-half as much. This means that a sign business is now within reach which never could be obtained before.

Mr. W. C. Anderson reported that in store-lighting practice in Canton one 250-watt tungsten lamp replaces a gas arc. Long life of 250-watt tungsten lamps was reported from both Canton and Dayton.

Mr. George C. Osborne said that the experience at Detroit was that the tungsten lamp sales decreased central-station earnings 25 per cent from existing arc and carbon lamp installations which they displaced, but inside of six months the same consumers would add enough tungsten lamps to bring the consumption up to the original figures. In Kansas City the tungsten lamp is competing with natural gas at 25 cents. It is notable that the sales of lamps by the manufacturers to contractors and supply dealers are mainly in the small sizes, while those to the central-station companies are in the larger sizes.

Mr. Henry Schroeder called attention to the fact that in some cases the carbon series street arc lamp is likely to be displaced by series tungsten lamps because of the efficiency of the tungsten lamp and the expense of trimming and repairing arc lamps.

Mr. F. M. Tait, of Dayton, gave some particulars of a trial installation for special lighting of downtown streets which has been placed on one of the streets of Dayton. Ornamental iron posts 75 to 80 ft. apart carry five 100-watt tungsten lamps. The scheme was fostered by the Chamber of Commerce of Dayton. The intention is to ask the storekeepers along the street to pay for the installation and the city to pay for the cost of operation and maintenance. The principal streets of Dayton are 110 ft. wide from curb to curb, and are level, so that it is believed a very fine effect can be produced with posts 75 to 80 ft. apart. It is expected that about 300 posts will be installed in the downtown district of Dayton.

Residence Lighting.

Mr. F. T. Mather, of the Edison Illuminating Company, Detroit, Mich., presented a paper at the Ohio Electric Light Association Convention, July 15, 1909, which gave valuable data about residence lighting in Detroit. This paper is largely quoted from a paper presented at the 1908 meeting of the Association of Edison Illuminating Companies, which paper covered a careful study of the conditions of residence lighting in Detroit for the past 10 years. It was published in the *Electrical World* of Nov. 7, 1908, to which the reader is referred for more complete figures than appear in this abstract.

Detroit, with a population of about 360,000, has 13,000 homes lighted with electricity. Electricity has no competitor in the high-class residences, little in the moderate-priced homes, and considerable business is secured among the owners of small cottages. Few homes are now built without electric wires. The proportion of old houses wired for electricity is increasing every year.

The rapid growth of this class of business dates from 1898, when the present Detroit residence rate was adopted. Its peculiarity lies in the method used in determining the amount to be charged monthly to each consumer at the primary rate, which is 14 cents per kw-hour. The amount so charged is 2 kw-hours per month for each room counted. Unfinished attics, storerooms, laundries, closets, bathrooms, stairways, halls, servants rooms, kitchens, pantries, porches and vestibules are not counted. Before adopting this method the Detroit company ascertained by observation that the number of lamps likely to be burned at the hour of the district maximum was actually very closely proportional to the number of these living rooms which are taken as the basis of primary charge. The secondary charge for electrical energy used in excess of 2 kw-hours per room counted is 4 cents, and fans, flatirons, disk-stoves and cooking devices are not counted on the demand charge, thus giving the customer the advantage of this low secondary rate for such devices.

The occupants of modest homes are desirous of electricity not only for lighting, but for the labor-saving devices operated with electricity. One concern selling washing machines has placed 450, mostly in houses where the laundry work is done by members of the family. Between 7,000 and 8,000 flatirons are in use on the company's lines. The average monthly revenue from a flatiron is estimated at about 50 cents. In the higher class of houses the vacuum cleaner is coming into general use.

The owner of a building is usually quick to appreciate the saving on decorations and furnishings when electric light is used. Some of the Detroit real estate dealers with large rental lists are inserting a clause in their leases providing for the exclusive use of electric lighting in their rented residences. This action on the part of the landlords was not solicited by the Detroit electric light companies. A display room in connection with the company's main office is in charge of competent clerks, who explain to visitors the uses of electrical appliances that may be employed in the home. Sales of this merchandise amount to about $10,000 a year.

From a central-station standpoint the company considers residence business very desirable. It has been found by studying several groups of residences at different periods that the ratio

of connected load to the district demand is more than 4 to 1. The company finds this ratio increasing as the practice of adding lamps for conveniences in halls, basements, closets, etc., becomes more common. The daily maximum demand of this class of business is fairly constant from the middle of October until the end of June. The maximum does not change much throughout the year. Demand indicators installed in 100 residence circuits showed a reduction of the demand in June, July and August, and the lowest summer maximum reading is 75 per cent of the winter maximum. Energy consumption is considerably less during the summer months.

The maximum demand of a residence district comes about 15 minutes previous to the time of the evening meal, and continues until 8 p. m., then falls slowly until 10:30. The residence district demand comes later than the business district demand, and is falling at the time the demand due to theaters and other places of entertainment is rising. The December sales in a middle class residence district are 3 or 4 per cent of the annual sales for the year, while the monthly midsummer sales may be 4 or 5 per cent of the annual sales. The annual load factor of residence lighting is approximately 1,000 hours' use of the maximum demand of the district. This figure was arrived at by analysis of the annual use of electricity in 905 residences in one group, and is based strictly on the district demand and not on the demand of the individual residence. Residence business is very stable and to a large extent self-propagating. This is especially true of the labor-saving devices.

Discussion.

Mr. W. P. Engle, who presided, said that there had been a general feeling that residence lighting was not very profitable in small towns, and that Mr. Mather's paper would open up an interesting field for discussion. Mr. J. Gilmartin, of Toledo, brought up the question of high investment per kw-demand for meters in residence lighting which he quoted from another authority as being about $40. This cost is considerably more than for generators. Mr. Mather said that it was the practice of his company to use the 10-amp Fort Wayne meter for all residence customers. One member pointed out that a 10-amp meter is more likely to run slow on light loads common in residences than a 5-amp meter.

Mr. Gilmartin said that the 10-amp meter costs but 15 to 20 per cent more than the 5-amp meter, so that the difference in cost is small. Some of the older commutator-type meters require frequent attention, but the alternating-current induction meters now used will give good results over a period of several years.

Mr. Mather said that his company tests meters when received from the factory before they are put in service and every six months thereafter. The minimum monthly bill under the Detroit residence rate is 50 cents. In answer to a question as to the Detroit practice in running three-wire services into residences, Mr. Mather replied that in congested territory three-wire secondary mains are used, but it is seldom that three wires are taken into a residence. Most of the services are two-wire. A deposit is required from customers who do not own the building or else a guarantee from the owner of the building. The deposit required is $5, upon which the company pays bank interest.

Mr. Mather told of a suburban town of 700 inhabitants near Detroit having 189 electric light customers. Most of these customers heretofore used kerosene and gasoline, as there was no gas in the town. There are 204 residences in that place. He said that the reduction of the minimum monthly bill from $1 to 50 cents is a big help in getting residence business among the smaller consumers. It is the policy of the Detroit company to make consumers' bills as low as possible for the service rendered and that can only be done by encouraging the use of the tungsten lamp. Mr. Mather says in soliciting residence business that on going into a house he remarks, "electric light will not cost you a cent." That is enough to arouse the interest of anyone, and he follows it up by showing how the saving in decorations and other items will make electric light free as compared with other lighting.

Mr. J. S. Kermode, of Cleveland, said that the introduction of natural gas in Cleveland instead of having a detrimental effect on electric lighting residence business, increased such business. He gave as the reason for this that the natural gas is used for cooking and results in such a reduction of the householder's bills that more money is available for the luxury of electric light.

Courtesy as a Commercial Asset.

By S. M. Kennedy.

THE two greatest factors in the success of any central-station business undoubtedly are courtesy and enthusiasm. These attributes must not be solely possessed by the president or manager, but must prevail in all departments, and in all ranks. It is true that your business may be the only one of its kind in your community and that the public must come to you if it wants service. Did you ever stop to consider that that very reason does not make the public less critical? If consumers are treated with consideration it is particularly pleasing to them, but if with discourtesy, it rankles through and through, because of the fact that they have no recourse, but must continue to do business with you. It should always be borne in mind that some men have short memories for favors, but all men have long memories for injuries. It is a regrettable fact that, as a rule, there does not seem to be a proper sympathy between the public and the electric company. It is hard to get them to understand each other. The public is very liable to think it is being overcharged or otherwise imposed upon, and the employees of a company to think the public "kicks" too easily and too frequently. But it would be well for the employee sometimes to put himself in the customer's place and understand that it is a reasonable thing for a man to ask questions about what he does not comprehend, particularly when he is paying out his money. No electric company can afford to be independent of the public. It is the public that buys from it, the public whom it must please and look to for its existence—the public that does not forget to remember. No matter how big the corporation, it is vulnerable—its very greatness sometimes making it a bigger and better target; and as for independence, the man who runs a peanut stand on a push-cart and has only a five-dollar capital invested in his business is a thousand times more independent than the corporation with its millions. If business leaves his corner, he can push his cart along to another location, but the public-utility corporation puts its money in the ground and cannot take it out, no matter what conditions may arise.

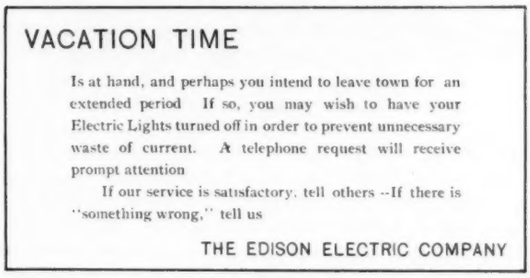
It seems reasonable to consider the subject of courtesy from two standpoints. The first is the kind which is desirable in the intercourse between the employees of a central station and the public, and which might be termed *conventional courtesy*. The second is the kind that reaches out, beyond the actual points of personal contact, and follows people to their homes. This, perhaps, may best be described as *aggressive courtesy*.

Now, it so happens that there are few businesses which give so many opportunities for the display of conventional courtesy as that connected with the central station. The public appreciates and enjoys considerate treatment. Why, then, should it be treated with hauteur, indifference and brusqueness by inconsiderate employees? Each and every man connected with a central station can do something daily to help his company's business. By careless inattention he can also do something that will produce great injury to its interests. The public does not judge a company by its president, officers and directors. They may be excellent men, with high standing in the community, but they are usually known to only a few of the company's customers. The men who are known are the clerks, solicitors, collectors, meter readers, and trouble men; these are the men who see the customers in the office, or meet them in their homes, who represent the company in its intercourse with the public, and it is by the words and actions of these men that the public praises or condemns their company.

A central-station business is not confined to any one class;

all classes must be dealt with, but there should be no distinctions between the big and the little, the great and the small, the rich and the poor, in the matter of treatment.

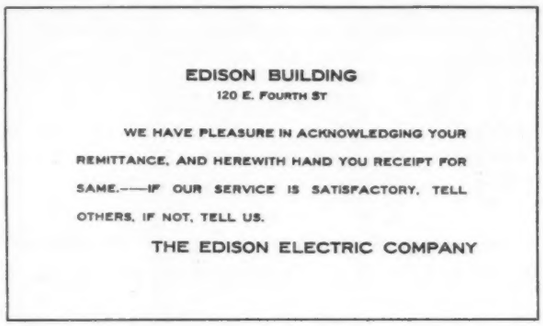
The importance of the complaint department of a central station cannot be too highly estimated. Upon the manner in which this end of the business is handled largely depends the friendship of the company's customers and the permanent growth and prosperity of the company itself. The proper treatment of complaints from existing consumers is much more important than the management of the "New Business"


VACATION TIME

Is at hand, and perhaps you intend to leave town for an extended period If so, you may wish to have your Electric Lights turned off in order to prevent unnecessary waste of current. A telephone request will receive prompt attention

If our service is satisfactory, tell others --If there is "something wrong," tell us

THE EDISON ELECTRIC COMPANY


EDISON BUILDING
120 E. FOURTH ST

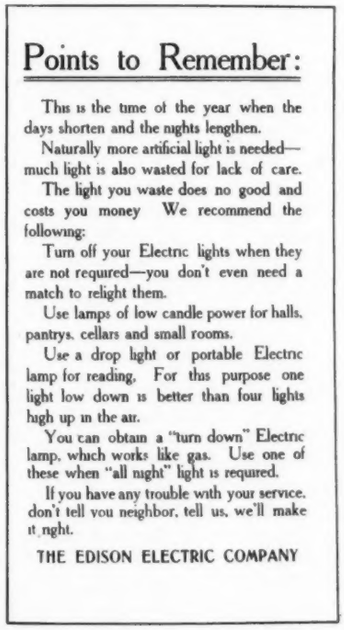
WE HAVE PLEASURE IN ACKNOWLEDGING YOUR REMITTANCE, AND HEREWITH HAND YOU RECEIPT FOR SAME.——IF OUR SERVICE IS SATISFACTORY, TELL OTHERS, IF NOT, TELL US.

THE EDISON ELECTRIC COMPANY

FIGS. 1 AND 2.—SPECIMEN FORMS SENT OUT BY LOS ANGELES EDISON COMPANY.

department, which is organized and operated to reach out after new customers. It should not be forgotten that satisfied consumers become active agents for the advancement of your company's business. Who, then, can estimate how much the growth of your business is retarded by customers who are dissatisfied through want of proper attention and courteous treatment? The more people you can get to think favorably of your business, the faster it will grow. And as a man thinks, so will he talk, and a pleased public means that you will have many people working overtime for you whose names do not appear on the payroll.

One of the best plans a central-station manager can adopt as a means of educating employees along proper lines, is occasionally to have demonstrations, showing what should be said and done under certain conditions of a more or less difficult char-


Points to Remember:

This is the time of the year when the days shorten and the nights lengthen.

Naturally more artificial light is needed—much light is also wasted for lack of care.

The light you waste does no good and costs you money We recommend the following:

Turn off your Electric lights when they are not required—you don't even need a match to relight them.

Use lamps of low candle power for halls, pantrys, cellars and small rooms.

Use a drop light or portable Electric lamp for reading. For this purpose one light low down is better than four lights high up in the air.

You can obtain a "turn down" Electric lamp, which works like gas. Use one of these when "all night" light is required.

If you have any trouble with your service, don't tell you neighbor, tell us, we'll make it right.

THE EDISON ELECTRIC COMPANY

FIG. 3.—NOTICE SENT TO CUSTOMERS.

acter. Once a month employees who come in contact with the public should be gotten together. Several of them should represent complaining customers, who come to tell their grievances Then let other employees receive these complaints and handle them as they think they should be handled. Let there be plenty of criticism and discussion, and it will be found that much benefit will accrue. Employees should be shown the importance of patience and self-control. It cannot be denied that some consumers may be utterly unreasonable, and even insulting, in making their complaints, and sometimes what is said is liable to put the average employee in a fighting mood. However, although a man may store up an awful tempest within himself, it won't break loose if he keeps his tongue tied down, and under such conditions a tied tongue is safer than a loose one.

If a man has a complaint rankling in his breast, get it out. Every complaint made is an opportunity given to make a new friend, and friends made in this manner are the sort which will put themselves out of their way to help you. You may have done little or much in your endeavors to please and satisfy a complainant, but the main thing is that you heard what he had to say, with attentive consideration; that you made him feel you were interested in his trouble, and determined to do what you could to make matters right. What you may have given him in the way of an allowance, or what you promised to do to improve his service, was only of secondary consideration. It is not unreasonable to assert that a complaint from a customer may even be welcomed, because of the opportunity it gives to strengthen the list of satisfied customers. It is not going too far to state that no adverse criticism should be permitted to go unchallenged. See the man who complains, and endeavor to get him satisfied. He won't be any worse as the result of a tactful interview, and the strong chances are that he will feel better toward you and your business.

The form of courtesy which may be termed "aggressive" is often evidenced along educational and publicity lines. This policy is one which points the way for consumers to remove the causes for trouble by displaying the proper care in the use of their service, and frequently invites consumers to bring in their complaints, sometimes even before the consumers themselves have realized that they might have occasion to complain. Every possible means should be used for convincing consumers that they are getting all they are paying for; that there is in reality no mystery about the electrical business, and that electric current can be accurately measured and correctly charged. This helps to establish confidence, and if confidence is maintained it means that more current will be consumed.

There is one company in the West (the Edison Electric Company, of Los Angeles) which covers a large territory and has many business offices frequented by the general public. In each office is a printed notice, neatly framed, and hung in a conspicuous place, where all may see it. The notice is signed by the company's president, and reads as follows:

"To Officers and Employees:—The Edison Electric Company desires to have the confidence and respect of the public, with which it deals. Officers, agents and other employees should, in every reasonable way, endeavor to increase that confidence and respect by doing everything in their power to make the name of the Edison Electric Company synonymous in the mind of the public for good service, square dealing and courteous treatment. The public gains its impression of the company through contact with its representatives, and employees will, therefore, be held responsible, in every instance, for the carrying out of the well-established policy of the company."

Along the lines of aggressive courtesy this same company works at all times to convince the people that it is also operat-

ing in their interests and is willing and anxious to do everything possible to make the relations between the company and its customers agreeable, satisfactory and profitable to all concerned.

The accompanying specimen forms and notices give some idea of the means adopted to educate the public and help consumers to help themselves, or if they cannot readily help themselves, to apply for assistance in the proper quarter.

Courtesy does not mean palaver, bowing and scraping, but common, ordinary, every-day politeness—the kind that shows a desire to please, the kind that can give back a smile for a frown and that says "thank you" when the opportunity occurs. This sort of courtesy is a fine art, and when practised will spread sunshine in places that would otherwise be gloomy.

Beyond all doubt, courtesy is an asset of incomparable value in the building up of a central-station business. It represents the easy way to get along—costs absolutely nothing, yet never fails to secure handsome returns.

INTERIOR WIRING AND ILLUMINATION

Street Lighting in Denver.

Sixteenth and Fifteenth streets, in Denver, Col., have been provided with ornamental trolley and lamp poles lining either side of the street, spaced about 100 ft. apart, and extending for nearly a mile along these streets. The effect is said to be handsome and dignified, and moreover involves a minimum of wires on these streets. Seventeenth Street is now to have a similar system of lights. The new poles have been designed, and will be in place Oct. 1, in time for the Street Railway Convention. A single arc light with 15-in. globe will be employed, and the idea of setting off the arc light with a small colored incandescent a couple of feet below will be omitted, although found very effective on Fifteenth Street. The Denver City Tramway has ordered the sectional poles, the ornamentation of which will consist of a base bracket and flanges.

Latest British Wiring Rules.

Unlike the United States, Great Britain does not possess an underwriters' wiring code that is applicable to all cities in the kingdom, or equivalent to the National Electrical Code of this country. The Phœnix rules are the most widely used, however, and approach more nearly those used here. These rules have just been revised and the main points of interest in them are given herewith so that a comparison with American rules may be made. The latter rules are used extensively in Canada. In some instances the Phœnix rules are at variance with the wiring rules of the Institution of Electrical Engineers. Warning is given in the introductory note in regard to the necessity of exercising care in accepting a tender for wiring, and intending users are recommended to retain advising engineers to design and supervise the erection of an installation.

The conductivity of copper conductors must not be below 98 per cent of that of pure copper, as defined by the Engineering Standards Committee (instead of 100 per cent, according to Matthiessen's standard). Current density is still to be taken as 1000 amp per square inch, up to currents of 100 amp, and no change is made in the minimum size of conductors. The standard of insulation for conductors to be used in damp places or in new buildings, and also for pressures between 250 and 500 volts, is to be 2500 megohms per mile (formerly 2000 megohms).

Additional regulations on conduit work are as follows: All piping should be erected before any conductors are drawn in. All joints in piping should be treated with aluminum paint. The use of T-pieces and elbows is not recommended; plain junction boxes should be used throughout. No single pipe must contain more than four wires. Open seam piping with socket connections is not recommended, and is only allowed for surface work and where the pressure does not exceed 250 volts.

Wood casing will be allowed in dry positions only. Wiring joints are only allowed in casing where unavoidable (in the old regulations permission was necessary).

Lead-covered wiring is now allowed, but it must be protected where it is liable to mechanical injury or chemical action. The lead covering must be grounded, and where alternating currents are used both lead and return conductors must be in the same lead tube or covering. Systems with unguarded return are now allowed after permission has been obtained.

Flexible wires and cords must not be joined to hard wiring, except by means of screw connections in a fireproof junction box. The insulation of flexible cords must consist of two coats (minimum thickness of each 10 mils) of pure Para rubber of high quality, or of one coat of pure Para rubber of high quality next the copper and two coats of vulcanizing rubber (the minimum radial thickness of rubber must be a total of 40 mils). Flexible cords not provided with an efficient flameproof outer covering must not be used in shop windows containing inflammable goods.

Surface systems of flexible twin wiring will only be allowed in situations where the wires will not be liable to mechanical injury or damp, chemical action, etc. The systems must be carried out to the approval of the Fire Office.

Ground wire must never be of less section than No. 14 S.W.G. (No. 12 B & S). It is recommended that one end of the grounding wire should be soldered to an approved ground connection and the other end attached to the case of the main switchboard or other iron-cased apparatus by means of a detachable screw lug.

Cotton mills and certain other mills are now included with hazardous risks as situations where, if arc lamps are allowed to be used, they must (unless of inverted type) have two globes, each completely and independently surrounding the arc, and the lamps should be of such design and make that the arc cannot be sustained unless the inner globe remains intact. The inlet holes for wires of portable lamps must be bushed. Flexible twin wires used in connection must be substantially insulated. The use of switch lampholders is not recommended. Where allowed they should be grouped and switch-controlled.

Where main switchboards are in connection with a system of iron or steel conduit it should be enclosed in a cast-iron case and glazed front. Where it is in connection with a wood casing or unprotected system, enclosing cases made of hard wood will be allowed. Distribution fuseboards must be of the same general construction as for main switchboards, and must be enclosed as for main boards. (This would imply a cast-iron case where tubing systems are employed.)

Lamp switches, two-way switches, etc., must be of approved type, and of not less than 5-amp capacity, and enclosed in fireproof boxes, the covers of which must be insulated.

The term "fuses" has replaced that of "cut-outs." A 50 per cent overload (except under certain circumstances when a larger amount is allowed) is still specified for fuses, but the minimum break is now 2 in. (1 in. was formerly allowed for 100 volts pressure). The distributing circuits from fuseboards must not carry more than 8 amp at 25 volts, 6 amp at 50 volts, 5 amp at 100 volts and 3 amp at 200 to 250 volts. Magnetic cut-outs and circuit-breakers must be of approved type.

The rules on dynamos and motors have been entirely rewritten. The maximum temperature of the dynamo at full load must not exceed 70 deg. Fahr. above the surrounding atmosphere. The rules for motors are:

Motors must be enclosed in substantial metal cases, which may form part of the construction of the motor; any openings in the case for ventilating purposes must be covered with metal grids. Slip rings of induction motors must be totally enclosed in metal cases, wherever they are exposed to the liability of mechanical injury or access of dust or damp, etc. Motors must not be placed in positions where they may be exposed to

mechanical injury, extreme damp or dust, unless suitably enclosed to prevent mechanical injury, ingress of dust or fluff or possibility of injury from access of damp. In risks where inflammable dust or vapor is present the motor must be enclosed in a substantial metal case without ventilating apertures, the pulley being external to the case. The case may be connected by suitably enclosed ducts or pipes to the outside air. All adjacent woodwork, both vertical and horizontal, must be efficiently protected with fireproof material. Wood floors on which motors are fixed must be lined with a sheet of metal.

Each motor must be protected by a switch and a fuse, or its equivalent, in each connecting lead. In specially exempted cases, such as a traveling crane, or a tool with one or two motors, then one switch to control the whole will be allowed. Each motor should be on a separate circuit. Each motor should be furnished with an approved automatic no-voltage and overload release. The frames of motors and all metal piping and metal-cased apparatus in connection must be efficiently connected to earth.

The temperature rise of motors under normal working conditions must not exceed 70 deg. Fahr. above the surrounding atmosphere as measured by a thermometer, provided the total temperature does not exceed 140 deg. Fahr. The terminals of motors should be so constructed as to insure that they are efficiently protected by metal covers or an equivalent device. In positions where motors are liable to collect dust, etc., and a totally enclosed motor is not required, the motor should be cleaned periodically by means of a small compressor or hand bellows. Excessive depreciation and trouble are found to occur through neglect in keeping the interior of the motors clean and free from dust.

Auto-transformers must be of sufficient capacity to stand an overload of 25 per cent for short periods. The transformers must be totally enclosed in strong cast-iron cases with removable lids. Terminals to be within the iron cases and the leading-in holes for cables fitted with bushes, except when metal pipes are screwed direct into the case. The metal cases and frames of transformers must be grounded.

The transformer rules have now been reduced to only a small fraction of their former length.

Supply mains should be carried in iron conduit and the apparatus in connection should be enclosed in substantial iron cases.

No telephone wire should be of less section than No. 20 S.W.G. (No. 19 B & S), and the insulation of the circuit inside a building should never drop below 1 megohm. A high-voltage fuse also must be placed upon each telephone wire.

All electric radiators should be fixed to, or stand upon, approved fireproof insulators. A wire guard should protect the radiator lamps. Every floor socket should be so constructed that the contacts are automatically covered when the plug is removed. Electrically heated flatirons and smaller apparatus should each have double fuses and a switch, and be independently grounded.

Street Lighting at Mishawaka, Ind.

Until recently the streets of Mishawaka, Ind., were lighted by arc lamps hanging from ropes suspended high above the street. These, scattered along from square to square, gave light at the crossings, but left the intervening spaces not only without appropriate illumination, but plunged in shadow. Early in the year the Mishawaka Business Men's Association decided that if the city could have plenty of power—it is locally known as "The City of Power"—it ought to have light in keeping. Immediately plans were made for a revolution in the city lighting system. Many suggestions were made for improving the old arrangement, but finally a column about 15 ft. long with curved lamp arms at the top was decided upon.

The execution of the plans was placed with the Dodge Manufacturing Company, of Mishawaka, and in short order the new posts complete were delivered and placed in position. Four to six were installed for each square and one or two thrown in for good measure where needed. Only the business section was covered, but as this represents a considerable area, a large number were required.

The posts are a combination of cast and wrought iron resting on a base 16 in. square. They were made in three sections, the first two being of 3-in. and 4-in. pipe and joined by cast-iron fittings. Two arms drop over from the side posts while four are used for the corners. These are made of 1½-in. pipe with ornamental scroll supports. The distance between the post and the arms is 20 in. The side posts have two drop tungsten lamps with one at the top, while the corner posts have five tungsten 40-watt lamps in opalescent globes. The posts are white.

FIG. 1.—LAMP STANDARDS AT MISHAWAKA, IND.

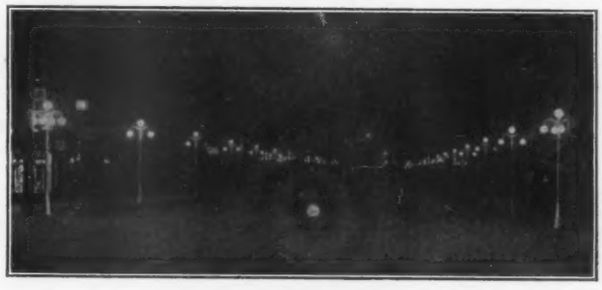


FIG. 2.—NIGHT VIEW OF MISHAWAKA STREET.

The new system makes a brilliant light flooding every nook and cranny of the shopping center. Mishawaka has a population of about 12,000 and claims to be the only city of its size in the country supporting a lighting system of this kind.

LETTERS TO THE EDITORS.

The Buckingham Printing Telegraph System.

To the Editors of Electrical World:

SIRS:—I have read with deep interest in your issue of July 1, 1909, the tributes paid by your correspondents to the memory of the late Mr. C. L. Buckingham. It was my good fortune to have an acquaintance with Mr. Buckingham that reached over nearly a quarter of a century, during which time I received many marks of his friendship. My acquaintance with Mr. Buckingham began while I was serving as an expert on the

opposite side of a case to the one on which he was engaged, and I can bear testimony to his uniform courtesy and gentlemanliness, both at that time and subsequently, under conditions that easily might have, but did not, provoke impatient action or remark by or from him. It was also my good fortune to be requested several years ago by Mr. Buckingham to undertake a study of his printing telegraph system for a certain purpose. In the course of this study I had numerous consultations with Mr. Buckingham on the subject and, like others of your correspondents, was often struck by the extent and ingenuity of his work along lines ordinarily so divergent from those of the legal profession. Having thus become familiar with Mr. Buckingham's printer, and being familiar also with the long-distance printer that is now in use on the circuits of the Western Union Telegraph Company, I read with some surprise the remark of your correspondent C. H. S., that while the Buckingham perforator is in constant use by the said company, his "printer has, it is understood, been set aside."

From information that has reached me I should be inclined to think that perhaps the Buckingham perforator may have undergone changes of recent years. The perforator, it may be said, is an admirable mechanical contrivance for preparing messages for automatic transmission and is susceptible of many variations in the hands of skilful mechanics. The highly ingenious essential features of the Buckingham printer, however, are not easily variable, but fixed, and they exist to-day in the modified Buckingham long-distance printer practically as they did when operated under the supervision of Mr. Buckingham. The essential difference between the Buckingham printer and the said long-distance printer as now operated consists in the displacement of the Buckingham type-wheel and cylindrical paper carrier by the typewheel and horizontal paper carrier of a typewriter for the printing of the message. The Buckingham alphabet, his main line relay, separator relay, escapement magnet, sunflower arrangement, unison magnet and wheel and his distributing of selecting relays all remain. These devices were all covered by United States patents which long ago were assigned by Mr. Buckingham to the company named. That much, at least, especially in view of the years of labor devoted to this invention and the fortune expended in its completion by Mr. Buckingham, should be said in justice to his memory and merits as an inventor; and it can be said without detracting from any credit due elsewhere for the successful application of the principles of his printer to the printing of telegraph messages by a typewriting machine.

New York. William Maver, Jr.

The Electrical Engineer of Low Salary Defended.

To the Editors of Electrical World:

Sirs:—During the recent Frontenac convention of the American Institute of Electrical Engineers a speaker, in advocating a broader education for engineers in order to enable them better to take an active interest in public questions related to their profession—a subject which has recently received much high-flown treatment in articles and addresses—remarked that there is no need of "intellectual mechanics." I do not find, however, that any enlightenment was offered by the speaker as to what constituted an "intellectual mechanic" beyond the statement that such engineers can be hired at a small salary in any numbers. Since, however, this type is by implication an undesirable one, and as the American Institute of Electrical Engineers has for its object the promotion and maintenance of a high professional standard among its members, would it not, in the interests of the profession it fosters, be desirable for that body to proceed to scrutinize carefully its membership roll to the end that any of this useless class found thereon may be summarily eliminated?

As the number of engineers who may be hired at low salaries is vastly in excess of those who enjoy large pecuniary rewards for their abilities—services—the speaker should have been more specific in his condemnation; furthermore, the present and prospective student should have plain warning on the subject in order that he may avoid being numbered with the reprehensible class, and technical schools should have a caution in order that they may desist from training "intellectual mechanics."

To look at the other side of the question, would the electrical engineering profession and industry be really benefited by the elimination of the "intellectual mechanic" if we assume that this term may fairly be applied to those whose work involves an absorption in detail, such as is necessitated in the designing branch of engineering works, in the detail department of engineers' offices, etc.? In point of fact, I believe that every engineer who has attained technical (though not necessarily high-salaried) eminence in his profession was at some period of his career an "intellectual mechanic."

It may be desirable to have a few electrical engineers who can talk eloquently to the public on the conservation of forests and dilate in statistical terms on the fact that when we use up the available coal supply none will remain for future power generation; but is there not in this country also hope of employment otherwise than humiliating for the "intellectual mechanic" who deals with technical detail, without which there can be no real engineering accomplishment—for the man who remains sufficiently old-fashioned in professional ideals to receive without bitter feeling the low compensation which appears incident to this class of work? If not, then this country may as well resign itself to a future perhaps of profitable electrical engineering exploitation—to quote a term from your own columns—but one barren as to technical originality; and also be content to depend absolutely on continental Europe for originative technical thought, inventive skill and the supply of works and office "intellectual mechanics."

New York. Hermann L. Jacobus.

Softening of Illumination Effect.

To the Editors of Electrical World:

Sirs:—Would it not be well to suggest to the manufacturers of artificial luminants, especially such luminants as tantalum and tungsten lamps and incandescent gas lamps, that in some cases where conditions would seemingly permit, such as in residences and similar places requiring a soft quality of light, that the glassware used, such as bulbs, chimneys, cylinders, etc., be of a slightly tinted shade of amber instead of clear glass; and that where parts of bulbs, chimneys, cylinders, etc., come within ordinary line of vision, they be ground or acid treated in order to assist in diffusing the light?

I feel that such usage would materially assist in popularizing luminants somewhat approaching the so-called white light, the quality of which is "hard" and does not assist in obtaining the "softness" of light which is so necessary in certain classes of service.

New York. A. J. Marshall.

Resuscitation from Electric Shock.

To the Editors of Electrical World:

Sirs:—The writer's work takes him to a great many electrical plants, and while he has noted that in most of these the chart issued by the *Electrical World* giving instructions for resuscitation from electric shock is posted, he finds very few men who have any adequate knowledge of how actually to proceed in case of an accident of this kind. If, however, employers and managers were to have a regular drill of their men in the application of the instructions, they would soon become proficient in their use. Unfortunately, so far as the writer has been able to learn, managers and superintendents go no further than to see that the instructions are posted in their plants.

The writer has had this matter very forcibly and painfully brought to his attention by the recent death of a friend from

electric shock, and in this case he is satisfied the man would be alive and well to-day had there been some one present at the time of the accident who understood how to apply the methods of resuscitation.

We all know there is a tendency on the part of any class of men to neglect the careful study of instructions of the kind above mentioned. And, again, it is well known that the study of printed instructions, no matter how well they are got up, is in nowise equal to personal drill under an instructor actually going through the motions, thus instilling the directions in the most lasting way. None of us would be willing to entrust our lives to a surgeon who had never witnessed or assisted in an operation, and for this same reason no employer who cares for the welfare of his men should be willing to have their lives dependent on ignorant fellow-workmen when such a condition can be so easily avoided.

In the opinion of the writer, this is a matter that might most appropriately be taken up by the National Electric Light Association and the American Street & Interurban Railway Association with a view to the appointment of a committee in each case to consider the advisability of the employment of competent men to make regular trips to power houses, car houses, etc., there to instruct the men as to the methods for resuscitation from electric shock. This work could be done in classes, but each man should be required actually to go through the various motions, using another man as a subject. For men of ordinary intelligence one or two lessons would be sufficient. It might be desirable to have an instructor visit each plant once a year, as the personnel of the plant often changes very much in that period. I feel sure that the trifling expense attached to this plan would be cheerfully borne by the different electrical companies if the matter were properly brought to their attention.

It is generally conceded by those who have made this subject a study that there are very few cases of electric shock necessarily fatal, yet we know that death by electric shock is becoming quite common.

HICKMAN, KY. F. J. FOOTE.

[We heartily agree with the suggestion of our correspondent. The usual effect of an electric shock is to suspend animation, and this can in most cases be restored by proper treatment. It may be added that in a case brought to our attention shortly after the issue of the instructions referred to in 1895, the patient was revived only after a treatment of two hours, thus indicating the desirability of forcibly impressing on men the value of the method of resuscitation and the necessity of carrying out the instructions to the letter.—EDS.]

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Auto-Converter.—An illustrated description of the "C. M. B." auto-converter made by a British company. It is a rotary converter with automatic regulation of the secondary voltage, by means of an auxiliary set of short-circuited brushes. In its simplest form, the machine consists of a ring-wound armature with a single commutator, and a two-pole field system divided into two parts as shown in the diagram of Fig. 1, where *a* is the main positive and *b* the main negative brush, and these are connected to the supply mains through an ordinary motor-

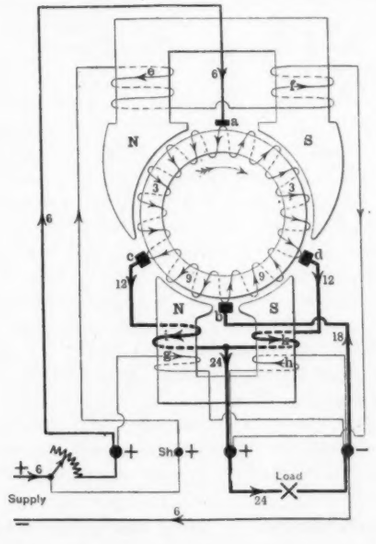


FIG. 1.—DIAGRAM OF AUTO-CONVERTER CONNECTIONS.

starter. The auxiliary brushes are represented by *c* and *d*, their position on the commutator being determined by the ratio of transformation required. If *a* is the positive brush, and the shunt windings *e f* are connected as shown, the armature will rotate in a right-handed direction, and the motoring parts of the armature will be those between the brushes *a* and *c*, and *a* and *d*. The generating portions of the armature are those between the main brush *b* and the auxiliary brushes. In order that the potential of the two auxiliary brushes shall remain the same at all loads, it is essential that the potential curve around the commutator should remain symmetrical. To reduce the distortion of the curve by armature reaction, and the consequent variation in the pressure at the auxiliary brushes the poles are divided as shown, with the result that there is very high reluctance to the armature cross-flux. By this diversion of the poles the motoring and generating fluxes are entirely separated and either side of the machine can be compounded so as to give any desired characteristic. The sectional areas of the poles are in proportion to the ratio of the transformation. The division of the poles also flattens the potential curve at the points where the auxiliary brushes are placed, and this tends to prevent sparking. The figures inserted in Fig. 1 represent the relative intensities of the current in the different parts for an assumed voltage ratio of 4 to 1, neglecting the shunt current and assuming an efficiency of 100 per cent. The machine acts as a true auto-transformer, the current in the generator portion being the difference between the load current and that supplied from the mains to the motor part. The diagram of Fig. 1 shows the connections for a machine wound to give a drooping characteristic—that is, a characteristic half-way between that of the ordinary shunt-wound and that of a differentially wound machine. Such a machine will automatically maintain a constant secondary current over a wide range of voltage and is especially suitable for supplying energy to arc lamps, as the latter can then be run without any steadying resistance. The currents from the two auxiliary brushes are first carried through the series windings *i* and *k* of the generating poles, the m.m.fs. of which are in opposition to that of the shunt windings. This arrangement has the effect of correcting the inevitable departure from symmetry in the potential curves, as well as giving the required drooping characteristic, because if the potentials of the two auxiliary brushes are not the same, a circulating current will be superposed on the load current. This circulating current will magnetize one pole and demagnetize the other and thus correct the dissymmetry. To transform from alternating current to direct current the armature is provided with slip-rings connected to the proper points of the armature, and the machine is run as a synchronous motor. Other applications of the machine are for reduction of the voltage for metallic-filament lamps or for a battery charge, also for use as a three-wire balancer, its advantages over the ordinary balancer being higher efficiency, lower cost, and smaller floor area. Fig. 2 shows the connections of the machine as

a three-wire balancer.—Lond. *Electrician*, July 9; Lond. *Elec. Eng'ing*, July 8. A long special article, by J. C. Macfarlane and H. Burge, describing the different steps in the gradual evolution of this machine, in Lond. *Electrican*, July 9.

Direct-Current Machine for Converting from Constant Pressure to Constant Current.—A note on a recent British patent of Brown, Boveri & Company (13,092, 1908; July 1, 1909). In this converter there are two direct-current machines coupled together; the exciting windings of each machine are in series with the armature of the other machine, and the fields are at

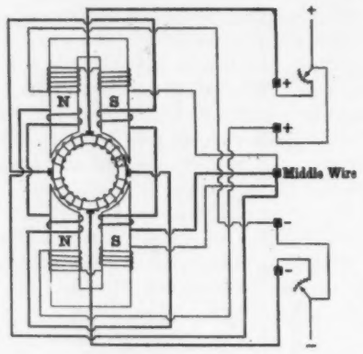


FIG. 2.—AUTO-CONVERTER USED AS BALANCER.

right angles. If a constant pressure is applied to one side of the combination, a constant current will be supplied from the other side. In a modified form of the invention, the excitation of the field system is effected by the armature currents; for a two-pole machine, four-pole pieces are provided, not connected by any yoke of magnetic material, but the adjacent poles of the two armatures are connected so that a flux flows parallel to the shaft. The fluxes produced by the two armatures are at right angles.—Lond. *Elec. Eng'ing*, July 15.

Cooling of Commutators.—A note on a recent British patent of Siemens Brothers Dynamo Works and F. F. O'Hagan (10,067, 1909; July 1, 1909). In turbo-generators in which a series of clamping rings are shrunk onto the commutator, it has been found that a blanket of warm air is trapped in the intermediate spaces between the rings, thus checking proper ventilation. To avoid this result, the present invention provides for suitably shaped draught-producing passages and recesses in the shrink-rings, which draw out the air or force it in more or less radially from or into the spaces between the rings, which thus act as centrifugal blowers.—Lond. *Elec. Eng'ing*, July 8.

Speed Regulation of Polyphase Induction Motors.—A note on a recent British patent of M. Stern (12,326, 1908; July 1, 1909). A method of winding the stator to obtain two speeds by running the motor first as an eight-pole, three-phase motor and then as a six-pole, two-phase motor is described. All the elements of the winding are used in each case. The method is applicable only to motors with eight poles or any multiple of eight.—Lond. *Elec. Eng'ing*, July 8.

Lamps and Lighting.

Reflector Lamp for Show-Windows.—An illustrated description of a new reflector lamp, comprising a low-voltage tungsten lamp enclosed in a flattened globe silvered on one side. Special nickeled flexible conduit for use with these lamps in shop windows and showcases has also been designed.—Lond. *Elec. Eng'ing*, July 8.

Generation and Transmission.

Turbo-Alternator.—An illustrated description of the new 3000-kw, three-phase turbo-alternator at the Pinkston power station of the Glasgow tramways, which comprises a steam turbine of the Parsons type, and a two-pole, 6600-volt alternator. The speed of the set is 1500 r.p.m. Interesting features of the turbine are the special means for fixing the shaft end in the drum at the high-pressure end of the rotor, and the automatic steam-operated by-pass arrangement. Features of the alternator are the careful arrangements for thorough ventilation of all parts of the machine, and the method of supporting the end connections of the stator windings. The rotor is built up of annular steel plates, and gun-metal end covers are provided to hold the end windings rigid against the centrifugal forces. Tests made on the set recently showed a steam consumption on full load of 14.66 lb. per kw-hour, at 146 lb. steam pressure, 93.3 per cent vacuum, and a superheat to 575 deg. Fahr.—Lond. *Elec. Eng'ing*, July 8.

Gas Producers for Low-Grade Fuels.—O. K. Zwingenberger.—A paper on the utilization of low-grade fuels, like lignite and peat in this country. The author thinks that the recovery of by-products would not pay, and recommends the conversion of these fuels completely into gas in a gas producer. The special features of a gas producer for this purpose are discussed and illustrated.—*Electrochem. and Met. Industry*, August.

Traction.

Choice of Frequency for Single-Phase Railways.—F. Eichberg.—A paper read before the Berlin Electrical Society on 25 versus 15 cycles for single-phase railways. The author discusses the effect of the choice of frequency on the weight and cost of generators, transformers, conductors, and motors. The conclusions of the author are strongly in favor of 25 cycles. The lower frequency permits some saving in line copper for long distances, but the first cost of all other parts of the system becomes higher with the lower frequency, and the possibility of taking energy from the railway line in towns in the neighborhood must be taken into consideration; this point is in favor of 25 cycles.—*Elek. Zeit.*, July 8.—The paper of Eichberg brought out a very extended discussion in which various speakers favored 15 cycles, with reference to various examples of American practice. Richter agreed with Eichberg concerning several advantages of 25 cycles, but stated that 15 cycles is more advantageous for the motor, especially for the series motor. Whether to choose 25 cycles or 15 cycles will depend on the question whether the other advantages of 25 cycles are considered more important than the greater reliability of the 15-cycle motors in operation. Reichel also discussed the advantages of 15 cycles, while Fleischmann agreed with Eichberg concerning the higher frequency. Richter pointed out that the choice depends greatly on the type of motor built by the company, which the engineer represents. Richter (series motor) favors 15 cycles; Eichberg (Winter-Eichberg motor) favors 25 cycles.—*Elek. Zeit.*, July 15.

Current Collectors for Railways.—P. Dawson.—In his long illustrated serial on electric traction on railways the author begins to discuss collectors for overhead conductors—namely, the trolley wheel and the sliding bow. For railway work the choice and design of the collector depend on the line voltage (which, in a given case, determines the current to be collected) and the speed. The author considers that for main-line railway working with high-pressure currents some form of bow collector, preferably operated by compressed air, is indispensable. He then describes the three types thus far employed —namely, the pantograph or scissors type, the ordinary bow type, and the rod collector of the Oerlikon type.—Lond. *Electrician*, July 9.

Electric Haulage on Canals.—G. Meyer.—An illustrated translation in abstract of his recent very extended German article in *Elek. Kraftb. und Bahnen.*—Lond. *Electrical Review* July 9.

Installations, Systems and Appliances.

Central Stations and Electric Lighting.—Some further communications with respect to the problem of making electric lamps more popular with the general public. B. Leitgebel emphasizes the necessity of facilitating the wiring of buildings. The electricity supply company should carry out the wiring and the owner of the building (not the tenant) should pay for it on the installment plan. The cost of the energy itself is less important, especially with high-efficiency osram lamps. The writer does not favor a flat rate, but recommends measuring the energy by meter. B. Goldenberg also emphasized the necessity of facilitating new installations; electricity supply com-

panies should be anxious not to make unnecessary and troublesome regulations.—*Elek. Zeit.*, July 8.

Bonding and Earthing.—W. J. U. SOWTER.—An article in which the author deals with the trouble which may arise through not bonding the lead and junction boxes of a high-tension system, and concludes with a plea for absolutely concentric systems and the abolition of tail boxes between concentric cables and transformers or switches. The following example shows the danger of neglecting the frequent inspection and testing of earth connections applied to transformers, etc.: A transformer in an outlying district was feeding energy to

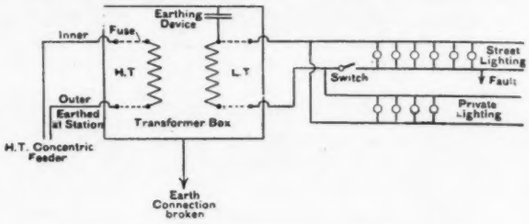


FIG. 3.—LOCAL TRANSFORMER LIGHTING CIRCUIT.

a few private consumers and a circuit of street incandescent lamps, as shown in Fig. 3. A short circuit was noticed on the high-tension feeder supplying energy to this and other transformers, which soon cleared itself. An examination revealed the fact that the transformer fuse had blown, due to the breakdown of a load inside the transformer case which happened to be protected by the fuse. It was also discovered that the whole of the street lamps had evidently been subjected to a very high pressure, as all of the lamps were blown to pieces, and the Cardew earthing device had operated. The transformer was tested for insulation, and found to be in order. The earth connection was examined, and it was found that the earth-wire was corroded away and broken where it entered the pit. There was also an earth on the switch wire of the street-lighting circuit, and the switch was open at the time. The inner when it broke down, evidently charged the case to full potential, and the high-tension current traversed the Cardew earthing device and passed to earth through the street lamps, by way of the fault on the switch wire. Where a concentric system is in use it should be concentric throughout. "For instance, concentric cables are often taken into substations or transformer pits, divided up, and rubber tails are extended to the transformers. It is surprising the number of distributing centers which are dealt with in this manner, and very few manufacturers of transformers appear to arrange their standard patterns for concentric lead-covered cables. In the former case it is obvious that, should earth connection of the case of the transformer fail, dangerous conditions may arise without warning; but a proper concentric system entails the occurrence of a short circuit if there has been any failure of insulation, and at the same time, if the lead sheathing is properly bonded at all joint boxes and at each transformer box, and connected to earth at several points, there is obtained a system which may be regarded as absolutely safe."—Lond. *Elec. Eng'ing*, July 15.

Melbourne.—J. H. DAVIES.—An illustrated description of the Melbourne Works of the Melbourne Electric Supply Company. The single-phase system is used, energy being generated at from 4000 to 4400 volts. The total full-load generator rating is 3925 kw. Four steam engines and steam turbines are used as prime movers. In order to supply energy to 1696 consumers at present connected, there are in use 46.7 miles of high-tension underground mains and 240 miles of overhead bare copper cable. The energy is available along 80 miles of streets. At the present time the equivalent of 157,934 lamps of 8 cp is connected to the mains, of which 2174 hp is represented in motors. The output for the past year has been 2,300,000 kw-hours, and this is increasing rapidly from year to year. The number of arc lamps which is daily attended to by the company, either under its public lighting contracts or under its system of rental, is 860. Almost without exception these lamps are of the flame type, supplied with energy through small pressure-reducing transformers.—Lond. *Elec. Review*, July 9.

Wires, Wiring and Conduits.

Cable Papers.—C. BEAVER.—An article on the composition and durability of cable papers with critical remarks supplementary to the recent article by Beadle and Stevens. Concerning so-called manila papers it is said that the cable manufacturer is flooded week after week with samples of alleged insulating papers which have not the remotest chance of ever being used for insulation. "These come largely from America and Germany, and it is a curious fact that while few samples from America contain anything but ligneous fibers of one kind or another, the best and most largely used American paper cables are insulated with pure manila paper. On the other hand, German cables are mostly insulated with paper either containing wood pulp in large proportions or made exclusively from it. In fact, some German firm states openly that wood pulp papers are better than manila papers, though justification for such statement from electrical or physical points of view has neither been offered in support of the statement nor demonstrated in practice." The author is convinced that paper made of pure manila hemp or flax, or even mixtures of them, will always be superior as regards durability and electrical and physical properties to those made from ligneous fibers. As to the detrimental effect of mineral matter in cable papers the author says that in papers containing only the natural amount of mineral matter, which for manila paper is usually between 1.3 per cent and 3.2 per cent, a considerable variation in insulation resistance and capacity occurs for 0.5 per cent variation in mineral matter. Again, insulation and capacity are affected when the character of the mineral matter varies. The relation between longitudinal and transverse strength is important, because it has a direct bearing on the structure of the paper—that is, the felting of the fibers. The average ratio over several hundred tons of satisfactory insulating paper recorded by the writer has been 2.02. As a further check on the structure of the paper the percentage elongation in both directions gives a useful indication. The average figures are 2.2 per cent for the longitudinal direction and 4.4 per cent for the transverse direction, giving a ratio of 0.5. The same issue contains a long editorial summarizing the results of the papers by Beadle and Stevens and by Beaver, which discuss the subject from the standpoints of the chemist and the electrician respectively.—Lond. *Electrician*, July 9.

Insulators.—W. WEICKER.—The conclusion of a long illustrated article in which the author gives a summary of the different types of suspended insulators, their development and construction, with general notes concerning the difficulties of construction, mechanical strength, electric perforation strength, and the occurrence of discharges over the brim in case of rain. He also gives comparative price and weight curves for suspended insulators and pin insulators, especially for higher voltages. Finally various forms of construction of insulators of the Hermsdorf porcelain factory are described, with figures for mechanical and electrical strength, weight, perforation voltage, and losses.—*Elek. Zeit.*, July 8.

Electrophysics and Magnetism.

Transient Phenomena in Circuits Containing No Capacity.—A. SCHWAIGER.—A theoretical paper on the transient phenomena which occur on closing or opening a circuit containing no capacity. After a general introduction, the author discusses the phenomena in direct-current circuits and in alternating-current circuits free of iron or containing iron, and also gives some comparisons with experimental results. As far as comparison of theory with experiments is possible, the graphical method described by the author enables one to solve even the more complicated cases.—*Elek. und Masch.* (Vienna), July 4 and 11.

Electrochemistry and Batteries.

Electrode Losses in Electric Furnaces.—C. A. HANSEN.—An account of an experimental investigation in which the author studied the best dimensions of electrodes for electric furnaces

in order to reduce as much as possible the heat lost through the electrodes. With graphite electrodes the efficiency of the electrode increases rapidly with increasing current density; but a limit is set by the fact that with increasing temperature of the electrode, the life of the surrounding furnace walls is reduced. The efficiency of the graphite electrode also increases within certain limits with the length of the electrode.—*Electrochem. and Met. Industry,* August.

Units, Measurements and Instruments.

A Source of Error in Needle Instruments.—J. F. Van Lonkhuyzen.—A note on a peculiar source of error in a needle instrument, due to an electric charge of the cover glass produced by friction. The phenomenon depends especially on the humidity in the atmosphere, and on the material with which the glass is rubbed, and on the kind of glass; it depends very little on the insulation of the needle from earth. The instrument is more liable to show this source of error, the smaller the directing force of the needle and the longer the needle and the shorter the distance between needle and glass. By one single rub with leather, the author has produced deflections of the needle by 5 per cent with different standards as well as switchboard instruments. In a heated room it was not difficult to produce with a dry hand deflections of the needle of from 10 per cent to 20 per cent from the correct value. The needle gradually assumes again its corrected position, but this may take from 10 minutes to an hour, and at any rate often sufficient time to result in a wrong reading. Static charges may also lead to errors if an instrument is connected to the secondary winding of a measuring transformer insulated from earth. It may then easily happen that the winding of the system assumes a static potential quite different from that of the frame, and curious errors may result. For this reason it is desirable always to earth the instrument and the secondary winding of the measuring transformer.—*Elek. Zeit.,* July 8.

Telegraphy, Telephony and Signals.

Telephone Lines.—Devaux-Charbonnel.—Continuations of his long serial on a study of telephone lines. The author continues the discussion of instruments for the determination of the constants of a line. He describes the bridge method with telephone, and describes small alternators suitable for such tests. He finds that the constants of lines are practically independent of the frequency. With respect to insulation resistance, he finds that even in the worst cases it is always of the order of several hundred thousand ohms. He then discusses the damping constants of a line. For distortionless circuits it is independent of the frequency, while for commercial lines the damping is greater for higher frequencies. In practice it is necessary to take into consideration the insulation of telephone lines to judge their quality for telephonic transmission. The poorer the insulation, the greater the damping effect. With respect to underground cables their insulation is practically infinitely great. As to the loading of telephone lines with Pupin coils, he finds that this has a very good effect for conductors of small diameter, while for cables of a certain diameter it is thought to be less advantageous than might be expected.—*La Lumière Elec.,* July 3 and 10.

Arc System of Producing Electric Oscillations.—K. W. Wagner.—The conclusion of his paper in which he investigates in general why and under which conditions a direct-current arc is able to produce alternating-current oscillations in a capacity circuit in parallel. The author gives a general review of the results of the more important investigations of this subject, and shows how they can be classified with the aid of Simon's "dynamics of the arc." The author describes some new experiments with arcs between metallic electrodes. Until recently such arcs were considered to be unsuitable for the production of oscillations, while from Simon's theory one would expect especially good results with them. Success has now been obtained, indeed. The lack of success of former experiments was due to the unsuitable choice of the condition of the experiments. With proper arangements simple metallic arcs in free air yield much higher frequencies than other systems, like the Poulsen lamp or the Telefunken lamp. An upper limit for the frequency which can be obtained has not been found. Especially for the highest frequencies the nature of the metal used as the cathode is of importance, while the nature of the anode metal seems not to have any influence.—*Elek. Zeit.,* July 8.

Electrolytic Detectors.—G. W. Pierce.—An investigation of the electrolytic detector with the aid of a Braun cathode-tube oscillograph. The author finds that the whole phenomenon of the rectification of small alternating currents by an electrolytic detector seems to be explicable in terms of the theory of electrolytic polarization. The polarization capacity of the small platinum electrode is not entirely negligible, even with currents making only 60 cycles per second. The polarization capacity may, however, aid in producing rectified current as well as oppose this effect, and, apart from the effect of the capacity on the tuning of the circuit, need not detract from the utility of the rectifier as a detector for electric waves. The present conclusion in regard to the action of the detector is entirely in accord with Pupin's original brief description of the phenomenon. There is a certain analogy between the electrolytic detector and crystal rectifiers, but the author has not yet reached a definite conclusion concerning the action of crystal rectifiers.—*Phys. Review,* July.

Miscellaneous.

New York Metropolitan District.—C. F. McKenna.—A paper presented before the American Institute of Chemical Engineers on the centering of great industries in the New York Metropolitan District, comprising besides Greater New York and suburbs, also Jersey City and Newark and suburbs. The author gives many statistical data and states that the developments of this district as technical centers for production of staples would be more rapid if certain extensive improvements could be made in which the advantages of separate State control by New York and New Jersey could be eliminated. A universal project for water supply is the most important of these improvements. Reclamation of large sunken areas adjacent to deep water to adapt them to normal uses of land is the next important improvement. Introduction of electric energy from the nearest large hydraulic works in both States is an improvement which gives promise of most extraordinary advantages, particularly for electrochemical and electrometallurgical development similar to that at Niagara Falls.—*Electrochem. and Met. Industry,* August.

BOOK REVIEW.

High-Speed Dynamo-Electric Machinery. By H. M. Hobart and A. G. Ellis. New York: John Wiley & Sons. 526 pages, 355 ills. Price, $6.

The major portion of this book is devoted to descriptions of high-speed generators that have actually been built, and the remainder deals with methods of design applicable to such machines. It may well be considered as a reference book for the designer of electric machinery. Much information is given relating to the thermal and mechanical limits encountered in design. The extra problems of providing insulation and mechanical strength when the speed is increased are fully discussed, while solutions that have proved satisfactory are outlined. The chief value of the treatise resides in the well-selected examples taken from present-day practice. The machines discussed are alternating-current generators, and continuous-current generators. Particular attention is paid to the voltage regulation of the former and the commutation of the latter. The commutatorless homopolar direct-current generator, which is useful only as a high-speed machine, is briefly described. The authors discuss an interesting original proposal to employ high-speed alternators in connection with synchronous converters for obtaining direct-current energy from steam turbines. The mechanical and thermal features of commutator construction are discussed in detail. The book will be welcomed as an addition to the reference library of the electrical machine designer.

NEW APPARATUS AND APPLIANCES

Interior Telephonic Communication on Battleships.

By D. H. BRAYMER.

On every United States battleship at the present time there are installed three independent systems for transmitting speech from one part of the ship to some other part. These are: the fire-control system, speaking-tube system, and the general telephone system which is generally known as the ship's circuit,

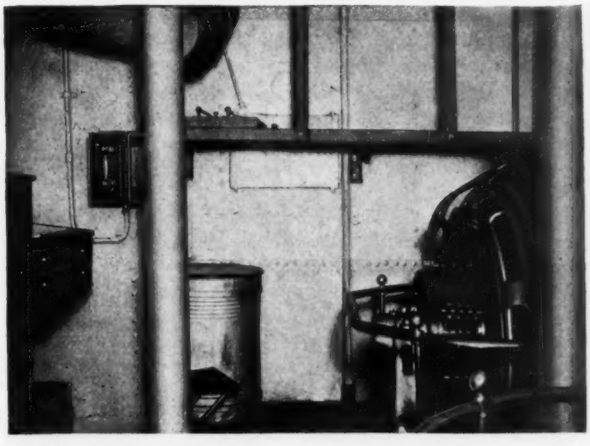


FIG. 1.—DYNAMO ROOM, U. S. "RHODE ISLAND."

with central-energy switchboard and operator. The first-named system is used exclusively for battle action and will not be treated in this article since the apparatus is special and its application does not figure in the general system of communication throughout the ship. The second needs no description.

The communicating service by telephone on shipboard is confined to the central-energy switchboard and its branches which connect all the important official positions with other portions of the ship for communication. Through the courtesy of the

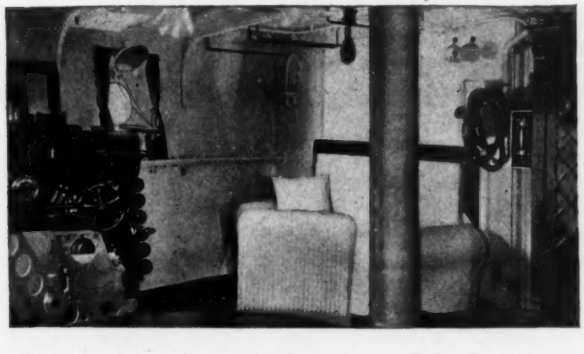


FIG. 2.—ADMIRAL'S AFTER-CABIN, U. S. "RHODE ISLAND."

United States Naval authorities the writer obtained photographs of the telephone apparatus on board the battleship *Rhode Island*, reproduced herewith.

The central-energy switchboard in use on the battleship *Rhode Island* is known as the marine type, manufactured by the Western Electric Company. Although its design was made applicable especially to battleship service, the principle upon which the board was built is the same as that embodied in the cordless private branch exchange switchboard, originally built for the Bell Telephone Company. The special features which make it applicable to battleship use are its proof against dampness, its compact arrangement, and the rapidity and positiveness of its action. The board has connections for 50 substation lines, five connecting circuits and one trunk line. As at present operated, however, there are only 40 stations connected, the trunk line being connected only when the battleship is in port. This connection enables the board to be connected with any long-distance line and operated as a private branch exchange.

The central station in which the switchboard is mounted is located near the dynamo room and is separated from it by sound-proof partitions. The board is mounted in a brass case which sets flush with the compartment wall, and so constructed that when closed the containing case is practically watertight. All the apparatus necessary in connection with the board itself is mounted in a very compact manner on the inside of the metal case, and although this case is moisture-proof, the key sections are hinged and so arranged that all parts are readily accessible for inspection and maintenance repairs.

Energy for talking and operating the signals is supplied from a small motor-generator set which is operated from the electric supply circuit. The motor-generator is of special design, the generator delivering energy to the busbars through a choke coil and from there to the connecting circuits through retardation coils. For the ringing circuit, a second motor-generator delivers direct current. For emergency, a battery equipment is used which may be either storage, dry or Le Clanché cells. The substations are equipped with direct-current vibrating bells. At the left of the switchboard is the low-voltage distributing board, which controls the battery circuits, bell circuits and telephone circuits.

At the switchboard, each substation line and the trunk line ends in a line key and line signal. Magnetic visual signals are used for both the line and supervisory signals. The key levers are arranged so that they can be thrown over a considerable angle, so that the position of any one key is at once apparent

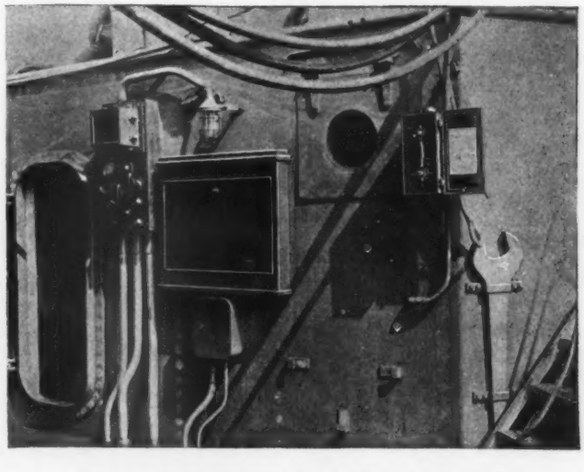


FIG. 3.—QUARTER-DECK, U. S. "RHODE ISLAND."

to the eye of the operator. The board is divided into two key sections; the first key section takes care of 25 substations, the second of 15—that is, the first section consists of 25 keys with three cam levers and the second of 15 keys, also with three cam levers. This arrangement is due to the fact that the space allotted for the installation of the board was not sufficient to accommodate the keys when arranged in one section. On account of the two-key sections there are at the left of these sections two sets of connecting circuit signals which are numbered 1-5; correspondingly numbered signals in the two sets

act in unison. The keys are placed with the axis vertical side by side in the case, giving three horizontal rows of 25 cams each in the first section, and three horizontal rows of 15 cams each in the second section. Each cam has two positions besides the normal or middle position and each key has six sets of operating springs, or three pairs of two sets each. Each one of these pairs is controlled by one of the corresponding cams.

Of the six sets of springs in each key, the upper five of these only, however, are used for connecting circuits; the sixth or lowest set of springs of the extension line keys is a ringing key for calling the extension station, the cam provided being arranged to restore automatically on being released, as is customary with ringing keys. At the right-hand end of the first section is the listening-in or operator's key. Above this there is no signal. Above each line key throughout the remainder of the board is a line signal of suitable type which is actuated by the hook switch at the extension station.

The operation of this board is as follows: On removing a receiver from the hook or taking a hand set from its containing case the corresponding line signal will show, say, No. 10; the

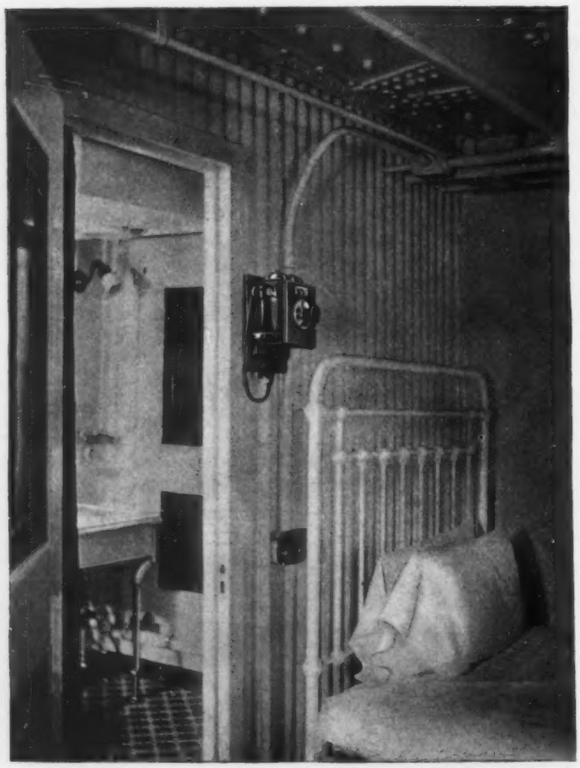


FIG. 4.—ADMIRAL'S CABIN, U. S. "RHODE ISLAND."

operator then throws the lever of the corresponding line key up or down, as the case may be, on one of the five connecting circuits which is not busy and also throws the lever of the operator's key on the same connecting circuit and in the same direction. This puts the operator in connection with the party calling at No. 10 and enables him to find out the party desired. If he desires No. 1 the lever of No. 1 extension line key on the connecting circuit used is thrown in the same direction as the other two, thereby connecting the calling party at No. 10, the operator and the desired line at No. 1. The operator then rings the bell at No. 1 by depressing the lowest lever of the No. 1 line key. When the two parties at No. 10 and No. 1 begin to talk the operator throws his key lever back to normal position. When the key lever of the calling line is thrown the corresponding connecting circuit signals are displayed and the line signal is restored. Also when the conversation is finished and both instruments are hung up, at the substation, the connecting circuit signals will disappear.

In a similar manner all five connecting circuits may be used and five separate conversations carried on at one time; the operator observing the condition of the line called for and of the connecting circuits as to whether busy or not. The five connecting circuits are represented by the five locking positions of the line key levers. Disconnection is made by restoring the levers to normal position.

In connection with the line and connecting circuit signals there is what is known as the "night bell." This bell is thrown in or out of circuit by means of a special key. The night bell is a feature which enables the operator to leave the switchboard and also warns him whenever there is a change in the line or connecting circuit signals.

The operation of the board with the bell connected in circuit is the same as that given above with the following exceptions: When the receiver is removed from the hook at a substation, the corresponding line signal is displayed and the night bell also rings. If this bell is not cut out by the key it will ring until the operator answers the call or until the receiver is replaced on the hook at the calling substation. When the conversation is through and both the instruments are hung up at the substations, the connecting circuit signals disappear and the bell will ring until cut out of circuit. This calls the operator's attention to the fact that the key levers corresponding to the two lines which have been in use should be returned to their normal positions.

Two types of substation sets are used in connection with this installation, a watertight set and a non-watertight set. The watertight set is shown in Figs. 1, 2 and 3, and contains besides the necessary apparatus a hand set consisting of receiver and transmitter mounted so as to be conveniently operated when held in one hand. When not in use this hand set is placed in the metal box, the bottom or transmitter end resting in a cradle and the upper or receiver end held by a spring hook which

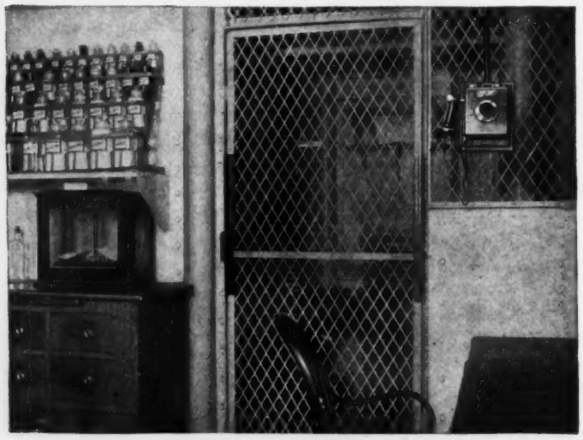


FIG. 5.—DISPENSARY, U. S. "RHODE ISLAND."

operates the same as an ordinary receiver switchhook of the central-energy telephone subscriber's set. This box contains all the necessary apparatus of the set and has its direct-current watertight bell mounted on the top. All frame work is of brass and the exposed parts, including the bell, have the standard navy black finish. When closed the lid is held watertight against a rubber gasket in the case by two clamp levers. The connection for the bell and conduit at the bottom are also made in such a way that when the set is closed it is as watertight as possible. These sets are used on all the gun decks and at all places except in the officers' quarters.

Fig. 1 shows the watertight set installed in the dynamo room. The lid of the containing case is open and the hand set is in place. The lid is so constructed that when open it is held by a hook so that the motion of the ship will not cause it to swing or close while the set is being used. On the inside of the lid is seen a directory which includes the 40 substations, a list of which is given elsewhere. Fig. 2 shows a watertight set in the admiral's after cabin. When the ship is stripped for action

this compartment forms one of the 3-in .gun stations, and to clean this station and put it in order water is used freely. A waterproof telephone set is, therefore, necessary in such a case.

Fig. 3 shows a similar set as installed on the quarter deck, just in front of the after 12-in. turret. This set is exposed to the weather at all times, yet its operating features are not affected on account of its damp-proof containing case.

The type of set used in the officers' quarters consists of a compact central energy telephone set enclosed in an oak case. A designation plate marks the substation name and also the line number. Fig. 4 shows the non-watertight set as installed in the admiral's stateroom, and Fig. 5 shows a similar set in the dispensary or "sick bay." This telephone station is a very important and essential one and plays a very prominent part in the medical service, not only when engaged in battle, but at all other times.

At the central station is a duplicate of all instruments for transmitting orders that are installed in the conning tower. The conning tower, which is heavily armored and immediately under the pilot house, is the station into which the commanding officer can retire during battle, and while watching through sight holes can transmit orders to any part of the ship. In case the pilot house and conning tower are destroyed while the ship is engaged in battle the commanding officer and pilot are accommodated in the central station. Here the commanding officer can give all orders to any part of the ship, and here also are provided all necessary means for steering.

Impulse Type Steam Turbine.

The E. W. Bliss Company, of Brooklyn, N. Y., has placed upon the market a steam turbine on which it has been experimenting for several years past, and which is shown clearly in the accompanying engravings. Structural strength has been a point most eagerly sought for. The turbine is being manufactured in all sizes from 10 kw to 1000 kw, and the designs include machines for both condensing and non-condensing service, and also for utilizing the exhaust steam from reciprocating engines. The exhaust steam turbine is especially adapted to manufacturing plants running at present through direct drive from a steam engine where plant extensions are contemplated. The exhaust steam machines are built in sizes from 75 kw up to 1000 kw.

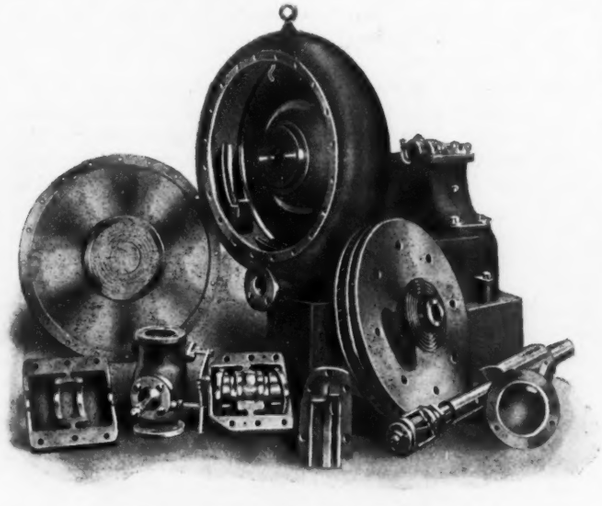


FIG. 1.—STEAM TURBINE DISASSEMBLED.

The general construction of the turbine is shown very clearly in the engravings. The casing is of cast iron having the steam chest carried concentrically around its outside and delivering the steam radially inward to each of the nozzles. An even temperature is maintained around the circumference, which does away with the necessity of having to bring any of the steam outside of the casing and then back into it again. This is a very important point in the successful operation of the machine, as it is sometimes desired to look inside of the machine, and if it is necessary to break several steam joints much trouble and annoyance are caused.

The rotor or turbine wheel is made of one solid piece of open hearth steel, which has the bucket seats milled into the periphery. The buckets are separated from each other by sheets

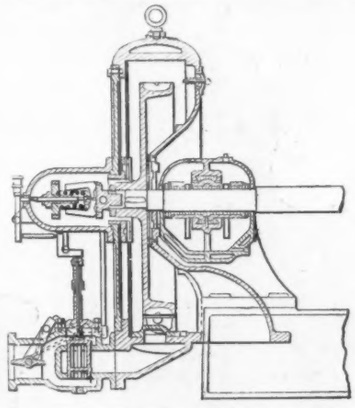


FIG. 2.—CROSS-SECTIONAL VIEW OF TURBINE.

of a special anti-corrosive metal, which are held in place by three steel bands shrunk on over the periphery. This method of construction makes a solid unbroken surface on the periphery of the wheel with no projecting parts, yet the wheel is as indestructible as if no separating pieces were used, and has not the disadvantage of requiring a new wheel in case of any trivial accident like the damaging of a single bucket in transportation or handling. The running clearance is 1/16 in., so that the machine cannot be considered delicate in this particular, and the construction is such that if by any combination of circumstances the turbine wheel should touch the casing, it would be a case of two smooth surfaces rubbing, like a brake shoe on a car wheel, and would cause no damage.

The steam is expanded completely in the nozzles, so that there is no difference in pressure between the buckets in the wheel and the reversing chamber, and consequently no loss from leakage. The reversing chamber is common for all reversals, so that the steam runs on a film of steam instead of on metal, which greatly reduces the frictional losses, as the relative difference in velocity of each layer of steam with respect to the next is very small, whereas with separate reversing chambers the steam velocity relative to the metal is exceedingly high and therefore causes large frictional losses, as the friction is very nearly proportional to the square of the relative velocities. The number of times which the steam is used on the wheel depends upon the steam pressure and the speed of the buckets, and in this nozzle the steam continues to strike the wheel as long as there is any energy in it.

FIG. 3.—TURBINE ROTOR AND ARMATURE.

In most designs the rotor is overhung, primarily in order to make a two-bearing unit for fan, pump and generating sets;

but four bearing units are built when desired by the customer and on all large machines. The center of gravity of the rotor is inside of the edge of the bearing, which is of the spherical type, and very generously proportioned.

As the only parts of the turbine requiring lubrication are the shaft bearings, it is absolutely impossible for any oil to become mixed with the exhaust steam. The method of oiling the bearings is by a ring oiler, which gives a positive feed lubrication without the use of an external pump. The oil is held in a rapidly revolving channel-shaped ring by centrifugal force, and is positively diverted to the bottom of the bearings by means of a scoop. This produces a positive oil pressure in the bearing at all times, whereas in the ordinary ring oiler most of the oil flies off from the ring, and very little is actually forced to the bottom of the bearings, where the greatest pressure and need of lubrication exist. Around the shaft is a steel labyrinth packing in which there is no contact between the stationary and rotating rings of the labyrinth. The packing prevents excessive frictional losses and does away with the trouble attendant with carbon packings or stuffing-box packings around a high speed shaft.

The governor is of the centrifugal type, and consists of two revolving weights supported upon hardened steel knife edges, and controlling a balanced governor valve through knife-edge connections. In addition to the main governor there is an emergency governor entirely independent and operating a separate valve. This emergency governor is set at a predetermined speed above normal, and in case of any possible overspeed of the turbine for any reason whatever, the emergency valve will be closed and the machine stopped.

Under the same conditions of steam pressure, back pressure and speed, the primary losses in efficiency in any turbine are caused by steam friction and leakage. In the "Bliss" turbine as the steam is expanded down to the back pressure in the nozzle, there is no difference in pressure between any part of the wheel and the reversing chambers, which makes it possible to run with a very large clearance, and still have no loss.

Electrically Operated Cash Registers.

Among the latest applications of electricity is the utilizing of a small motor to operate cash registers, in place of turning a crank handle, and a system of incandescent lamps to illuminate the upper part of the register where the amount of the sale is displayed, and attract the customer's attention. The National Cash Register Company, of Dayton, Ohio, has developed for this purpose a small and efficient motor of approximately ⅛ hp, which is capable of operating on any electric-light circuit with voltages from 40 to 250 on direct current; and from 75 volts to 250 volts, with 10 cycles to 140 cycles on alternating current, by simply changing the field coil windings to suit the required conditions.

The register with motor and lamps attached is shown in Fig. 1, the hood which covers the motor being removed to expose it to view. The motor is not a continuous running machine, but only runs when the register is operated. The action of the device is as follows: When a purchase has been made the proper amount keys are depressed and the clerks' key is then pushed, which by means of a cam automatically puts the motor in circuit and lights the lamps on the register. The motor carries the register through its operation and is thrown out of action, the whole time required being about two-thirds of a second. The lamps continue to burn for a few seconds, the exact time of illumination being predetermined by the adjustment of a small dash-pot controlled time-limit switch, which is capable of holding the lamps in circuit for a period varying from one-half second to one minute, as desired. This switch with its dash-pot, will be plainly seen in both Fig. 1 and Fig. 2. It will be noticed that the switch is of the spring contact type, making a straight up-and-down contact instead of having a wiping action. These springs are fitted with contact points or buttons of a special non-arcing alloy and are free of sparking during both making and breaking the circuit. A 1 m.f. can-type condenser (shown in Fig. 2), made especially for this purpose, is cut across the switch at the motor end and serves to prevent the arcing.

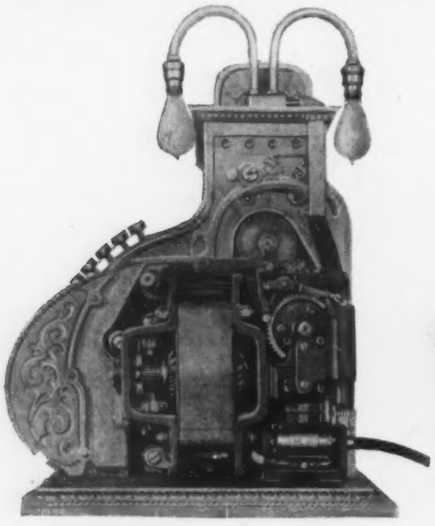


FIG. 1.—MOTOR-OPERATED CASH REGISTER.

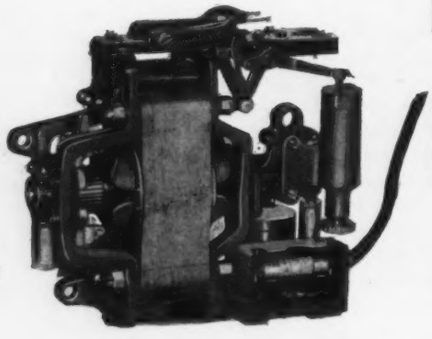


FIG. 2.—DETAILS OF OPERATING MECHANISM.

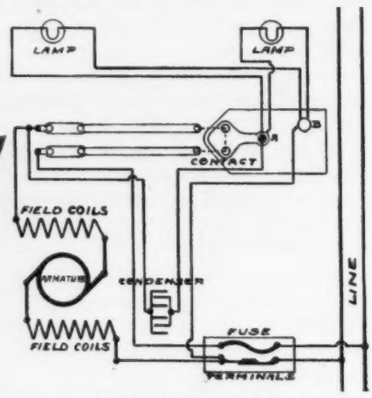


FIG. 3.—MOTOR WIRING DIAGRAM WITH ILLUMINATED INDICATOR.

The motor is a series-wound machine, with a field of the double magnetic type, and is of the usual laminated construction to enable it to operate efficiently on either alternating or direct current. The insulation in this motor is high, as the conditions of operation are such that high-grade insulation is absolutely essential. The motors are tested at 1000 volts, applied both steadily and intermittently several times during construction, and also after assembling upon the cash register. All field coils and armatures are vacuum impregnated and only the highest grade materials enter into the construction of the entire machine. A standard motor has been run continuously for over two weeks entirely submerged in a tank of water without a breakdown.

The connection to the lighting circuit is made with a length of New Code show-window cord and a Benjamin plug, which may be screwed into any lamp-socket. The other end of the cable is connected to the hard-rubber terminal and fuse block shown in both cuts, and from this point a wiring form conducts the current to the switch and condenser. The terminal block is equipped with spring clips for standard cartridge fuses, and is usually fused for 3 amp except on high frequencies, where 4-amp fuse is used. The torque and commutation of this motor when running upon alternating current is exceptionally good, as will be realized when it is considered that the motor starts from a state of rest, accelerating to full speed and completes the register operation in two-thirds of a second. Fig. 3 shows diagram of both the motor and lamp connections, and the location of the condenser in the circuit can be plainly seen.

Motor-Starting Rheostat.

The Ward Leonard Electric Company has standardized a motor-starting rheostat equipped with a device effectually short-circuiting the series field of a compound-wound motor when the motor has been accelerated to full speed. It is used in

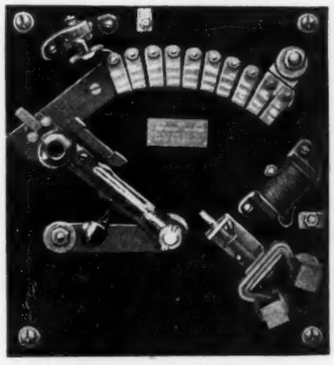


FIG. 1.—RHEOSTAT WITH DEVICE FOR SHORT-CIRCUITING SERIES FIELD COILS.

starting motors which have been designed to obtain a high torque during the period of starting only, it being desired to obtain a constant speed under varying loads after the motor has been brought to normal speed. It has also standardized a

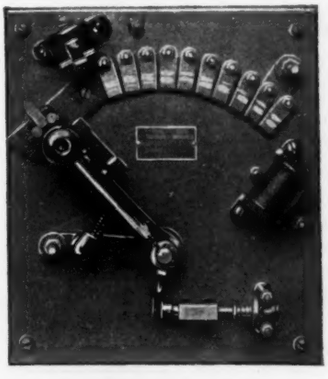


FIG. 2.—RHEOSTAT WITH DISTANCE CONTROL RELEASE.

no-voltage release motor starter equipped with a dynamic break and push-button release for use in starting motors and in enabling the operator to stop the motor at any desired point by the operation of a push-button or other type of switch.

Steel Tie and Splicing Wrench.

The purpose of the wrench shown herewith, and marketed by Mathias Klein & Sons, of Chicago, Ill., is to "tie in" a line wire to the insulator. In practical use the tie wire, already bent in the customary U-shape, is slipped over the insulator with the open end of the U resting on the line wire; then one of the

STEEL TIE AND SPLICING WRENCH.

ends of the U is put through the hole in the eye, and the tool is shoved back against the line wire. By a rotary movement of the wrench around the line wire the tie wire is curved around it in the form of a spiral. The other end of the U is likewise treated, and the line is permanently fastened to the insulator. It is customary for linemen to do this work with pliers, but the wrench is said to be a time saver, and to enable a clean job to be performed without danger of nicking the line wire. The splicing end is intended for use with the splicing clamp. The ends of the wire to be connected are held with the latter, and the projecting end is caught with the shoulder of the wrench, whence by turning the wrench around continuously the wire is coiled tightly and evenly on the line wire, making an effective splice. The device is made for tying-in wires from No. 7 to No. 11, and for splicing Nos. 4, 6, 8, 9, 10 and 12 iron wire or Nos. 2, 4, 6, 8, 10 and 12 copper wire. The wrench measures 7 in. over all.

Bituminous Gas Producer.

The bituminous gas producer shown in the accompanying illustrations combines the principles of the down and the up-draft types. It is mechanically fed by dividing the generator into two sections and rotating the lower portion. The generator is both mechanically stoked and mechanically fed. The fuel is admitted on one side of a dividing wall built through the producer, and by the admission of air and steam at both top and bottom the gases are driven down through the fuel bed under the dividing wall, thereby converting the tar and other heavy hydrocarbon into fixed gases.

As the generator is divided in the center of the fuel zone an incandescent body of coke is always maintained on the outlet side, and the gas in passing through this incandescent fuel zone is filtered free of dust and soot, so that in leaving the generator it does not, it is stated, contain more than 31/1000 grain of tar, soot or other impurities per cubic foot.

Another improvement in this type of generator is in the con-

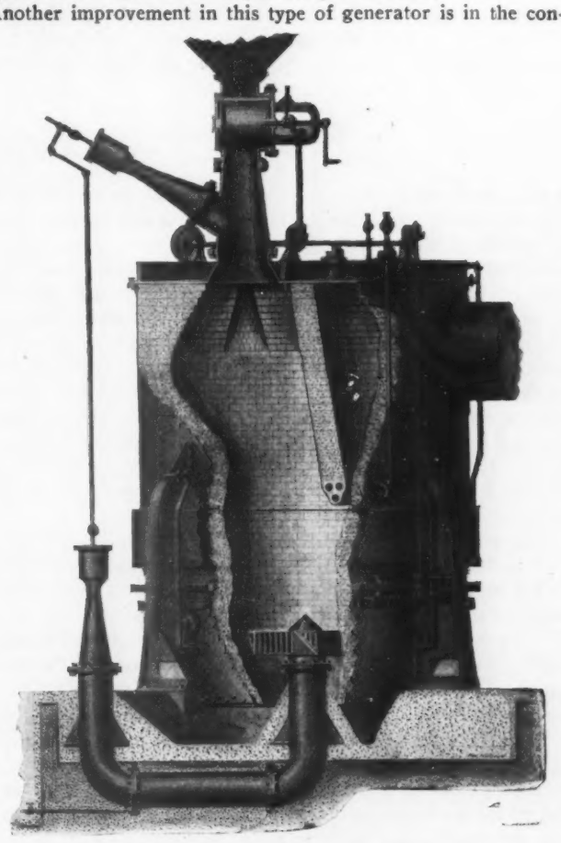


FIG. 1.—BITUMINOUS GAS PRODUCER.

struction of the lower tuyere, which is stationary and around which the bottom section of the producer rotates. This tuyere consists of four cast-iron arms, triangular in shape, with openings on the back through which the air and steam are admitted to the generator. Owing to the triangular shape of these arms and the lower section rotating against them, caking or clinker-

ing is prevented; or should any clinkers form from any undue cause they are broken up, and with the ashes are forced downward through the water seal.

The gas from the producer is conducted through a "Down-Comer" into a cast-iron box and by raising the water height this box acts as a hydraulic valve, cutting off the producer from the plant. The purge stack is connected to the top of the "Down-Comer," and the gases at night, or when the plant is not in operation, can pass either to the atmosphere or through a duct to the boiler for making steam.

The scrubber consists of a circular steel tank provided with a canopy over the gas inlet and a number of water sprinklers at the top. The gas is admitted into the bottom of the cooler and is taken off at the top. The cooler is set in a water-sealed pit, the bottom of which is provided with a sloping side for the collection of tar.

The washer is of the vertical three-stage water-sealed type. The gas is admitted to the center of the washer, and the water is sprayed on the first series of wheels by centrifugal force; the gas is then drawn through the first series of wheels and forced against a number of deflecting rings, on which water is sprayed and where the gas and water intermingle. In the second stage the gas is rotated at a high speed and passes through a mist of water, coming in contact with three series of stationary baffle rings. In the third stage gas is also rotated at a high speed and leaves the washer under pressure of from 6 in. to 12 in. water gage.

The washer is driven by a steam turbine mounted directly over it, and the speed of the turbine is governed by a gasometer which acts directly upon the turbine governor. The exhaust steam is used in the producer for making gas.

The gas is made in direct proportion to the demands upon the plant. As the load is increased, the pressure tends to decrease, which allows the gasometer to fall, which, in turn, acts on the turbine governor, speeding up the turbine to maintain constant pressure. Increase of load on the turbine tends to increase the pressure and amount of exhaust steam, which, in turn, increases the steam pressure and air pressure on the generator; and as the generator is driven by the same turbine which operates the washer, any increase in the turbine speed tends to increase the speed at which the lower section of the generator revolves, as well as to increase the amount of coal fed through the mechanically operated hopper.

The gas from the washer is passed through a dry cleaner, which consists of a steel tank with a water-sealed top, and provided with two baffle plates for holding excelsior, through which the gas must pass. This excelsior is treated with oil, so that the gas passing through it and the oil filters out any soot or dust which may have been carried through the washer. The tar storage tank is provided with heating coils, and by closing the valve at the top and admitting live steam the tar is forced from the storage tank to the collecting tank on top of the boiler and fed by gravity to the tar burner, where, by the admission of steam, the tar is atomized and burned under the boiler for making gas.

These generators are stated to be capable of gasifying slack bituminous coal, lignite or peat. The design permits the admission of air and steam at both top and bottom, where moist fuels are used. Anthracite screenings or low-grade fuels which would stop up the ordinary type producer can, it is stated, be successfully gasified in this type.

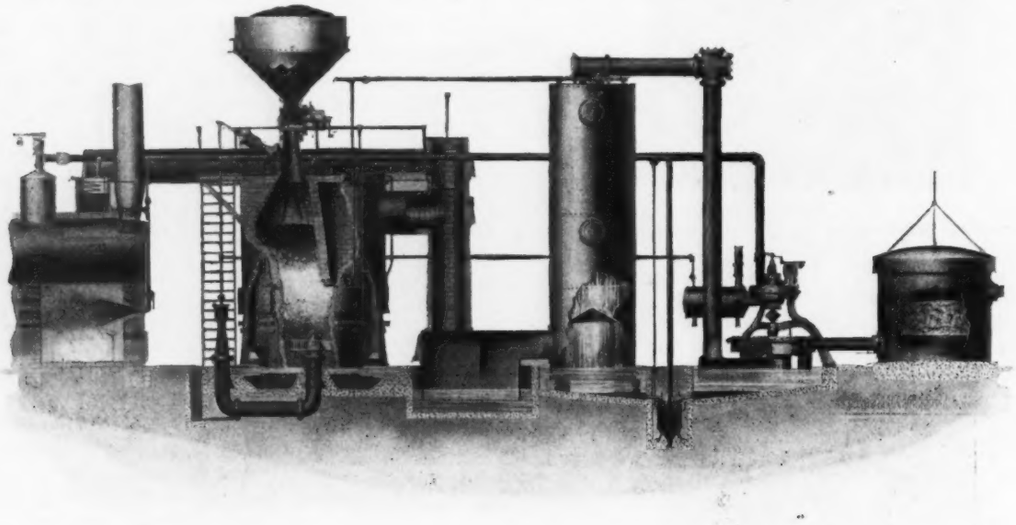


FIG. 2.—PRODUCER GAS PLANT CONNECTIONS.

This producer is stated to have an efficiency of 80 per cent at full load and to be capable of being operated continuously. It is manufactured in sizes from 200 hp up; in large sizes two or more generators are furnished, but usually one cooler and scrubbing apparatus is all that is required. This apparatus is manufactured by the Hill-Hupfel Engineering Company, 30 Church Street, New York City.

Street-Lighting Fixture.

The illustration herewith shows a street fixture brought out by the Wheeler Reflector Company, of Boston, for use with a prismatic street lighting reflector. The fixture consists of a 4-ft. bracket of 1-in. iron pipe (large enough to conceal heavily insulated cable) supported by a wrought-iron scroll, a high-tension mica insulating joint, a cast canopy which acts as a housing for the socket and support for the shade. A 16-in. porcelain enameled steel reflector fits above the prismatic glass reflector and intercepting the light which passes upward through the glass reflector, diverts it to a useful direction, adding over 10 per cent to the light radiated at an angle 15 per cent below the horizontal by the prismatic reflector.

STREET LIGHTING FIXTURE.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Conditions of trade continue to improve in general, without there being very much in the way of specific betterment that can be pointed out. There are more buyers in the leading jobbing centers and fall trade seems to be getting under headway with more vigor than was anticipated. The settlement of the tariff question—which early last week the merchants accepted as a fact—has done much to stimulate trade. Trade has been held largely in abeyance pending the adoption of a definite basis upon which business could be transacted. Just as soon as the schedules of the conference committee were reported it was accepted that these would be the final rates and the rush to market began. Every other condition is an inducement to the retailer to buy. The crop situation is almost uniformly favorable. There will be bumper yields of spring wheat and corn, winter wheat has turned out better than was anticipated some time ago, barley, oats and hay are all good, and even though there will be some reduction in the size of the cotton crop the advance in prices promises a better return to the planters. All of these things indicate that the producing sections of the country will have plenty of money to spend during the coming fall and winter and as retailers' stocks have been considerably depleted the necessity for liberal purchases is apparent. In industrial sections the outlook is equally encouraging. In almost all lines of manufacture increased orders have brought about the employment of additional operations and the buying capacity of industrial communities is rapidly increasing. Just at the present time retail trade in all parts of the country is largely of a clearance-sale character, and this in itself is doing much to clear the shelves of carry-over stock. Railway traffic is enlarging and the heavy wheat movement which is just beginning is doing much to decrease the numbers of idle cars. The equipment companies, especially the car builders, report that very satisfactory orders are being received from the railroads. Business in structural materials and other finished steel products continues in good proportions and prices are gradually being advanced all along the line. Plain wire, rods and rails were marked up $2 per ton last week, thus recording an advance of $4 per ton since May 1. The electrical companies all show steady growth in orders although the reports as yet are that the main volume of business continues to be for small equipment, rather than for heavy apparatus. Collections are somewhat improved, but are not as yet up to what might be expected from the general revival of commercial trade. Business troubles are not serious and few heavy failures are recorded. Failures for the week ended July 29, as reported by *Bradstreet's*, were 223, as against 239 the week previous, 275 in the same week of 1908, 142 in 1907, 170 in 1906 and 178 in 1905.

THE COPPER MARKET.

The new method of trading in copper was inaugurated on the New York Metal Exchange Aug. 2. For the first time actual sales of copper were made, and the quotations given out by the exchange were the result of bona fide transactions. The total sales for the day amounted to 225 tons in single carload lots—that is, 25-ton lots—at prices which ranged at from 12¾ cents for spot to 13 cents for October delivery. These prices indicate a quotation that under the old system would be about 13 @ 13¼ cents for electrolytic. During the past week the course of the copper market has been the reverse of the week previous. Instead of an advance upon manipulation in London, prices during the past week have receded ¼ cent per pound, brought about by the liquidating of speculative holdings abroad and by a reduction in the asking prices of the Amalgamated interests. The takings by domestic consumers continue to be very light, and it is the general impression that the stocks in the hands of the manufacturers are ample for all immediate needs. The output continues to be at the maximum, and it is estimated at the present time to be running at the rate of almost 4,000,000 lb. per day. Exports for July were particularly heavy, amounting for the month to 35,046 tons, which is 1,647 tons in advance of the June exports, and nearly up to the record mark made in December, 1907. Imports continue to be quite liberal, and during July will amount to something like 13,000 tons. At the close of the market Aug. 2 a stronger tone seemed to have developed, and a number of inquiries were reported from large exporters for 1000-ton lots of electrolytic. It is said that these inquiries named 12⅞ cents as the purchasing price. The daily call at 12:30 on the Metal Exchange for standard copper on Aug. 2 was as follows:

Standard Copper— Cents per lb.	Bid.	Asked.	Settling Price.
Spot	12.60	12.80	.....
August	12.75	12.85	12.80
September	12.80	12.90	12.85
October	12.95	13.05	13.00

The London prices July 31 (Aug. 2 was a holiday) were as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	58 7 6	Closed until next Tuesday.
Standard copper, futures	59 5 0	
Market	Easy	
Sales of spot		600 tons
Sales of futures		500 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	.....	.....
Lake	14.55	12.55
Electrolytic	14.25	12.12½
Casting	14.12½	12.00
London, spot	£64 2 6	£54 12 6
London, futures	64 17 6	55 10 0
London, best selected	67 15 0	59 0 0

THIRD AVENUE SALE POSTPONED.—Judge Lacombe, of the United States Circuit Court, has entered an order postponing the foreclosure sale of the Third Avenue Railroad Company's property from Sept. 2 to Oct. 27. The order also postpones until Sept. 27 the filing of the inventory of the property that is being made by the special master. The postponement of the sale was made at the request of the Central Trust Company, which procured the decree of foreclosure.

THE DENVER GAS & ELECTRIC COMPANY has secured a long lease for its office home in a new 10-story fireproof building, at Curtis and Fifteenth Streets, Denver. Excavation is proceeding rapidly. The building will have its architectural features effectively outlined with various exterior light arrangements. J. Fischer is the illuminating engineer. It is proposed to make the building at night the most attractive in Denver.

MILFORD (MASS.) ELECTRIC LIGHT & POWER COMPANY.—The Milford Electric Light & Power Company, which has plants in both Milford and Hopedale, Mass., has executed a mortgage on its property for $200,000 to secure an issue of 5 per cent gold bonds, payable June 1, 1929. The proceeds of these bonds will be used for extending the distributing lines of the company and taking up outstanding obligations.

GENERAL ELECTRIC COMPANY SELLS AIRBRAKES.—The receivers of the Metropolitan Street Railway Company have purchased from the General Electric Company 250 airbrake equipments, which will be installed upon old cars which are now being converted into pay-as-you-enter type. The Metropolitan intends to have every car in its service eventually equipped with airbrakes.

A TRAINLOAD OF MOTORS.—Buying electric motors by the trainload is an unusual transaction, but such a deal was recently consummated by the Gregory Electric Company, of Chicago. The purchase was made from the Union Electric Light & Power Company, of St. Louis, and consists of new National motors, the shipment of which will require 16 freight cars.

WESTINGHOUSE TURBO-GENERATORS.—The Torrington (Conn.) Electric Light Company is adding a 500-kw Westinghouse turbo-generator to its station equipment, and the Sea View Railroad Company has installed in its power house at Hamilton, R. I., two 400-kw Westinghouse turbines and alternators.

ELECTRICAL BUSINESS SLOWLY EXPANDING.—It is stated that the General Electric Company at the present time is employing about 25,000 workmen. This is an increase of about 1500 since Feb. 1. The increase has been gradual, keeping pace with the slow but constant improvement in sales. The present employment of labor is about midway between the high and low records. In the boom times of 1907, the company had about 31,000 workmen, and in the most depressed times of the panic it employed only 19,000. The Western Electric Company reports a continuous increase in sales. During the first seven months of the company's fiscal year, which ended with June 30, the greatest gains were shown in the Middle-West section, while the Pacific coast was next greatest in the matter of improvement. The Eastern coast section has shown comparatively small improvements. Of late the export business has shown much greater activity. For the first six months the returns ran about neck and neck with those of a year ago, but the June increase of almost twice the exports of the preceding June brought the seven months to about 10 per cent ahead of the corresponding seven months record in 1908. Of the gains reported by the Western Electric the largest percentage of increase is the gain in the cable business. The other two branches which show the most important gains are the telephone branch and the power apparatus branch of the company's operations.

MEXICAN ELECTRIC PASSENGER & FREIGHT RAILWAY.—The ancient town of Ysleta is to soon be connected with El Paso by an electric interurban railway. The El Paso & Fort Hancock Railroad Company has been organized to build an electric railway down the Rio Grande Valley from Fort Bliss to old Fort Hancock, passing through the towns of El Paso and Ysleta. The proposed line will be about 60 miles long and will do both a passenger and freight business. A great impetus to the agricultural development of the valley region both below and above El Paso has been given by the assurance of the early completion of the great Elephant Butte dam and irrigation project, which is a part of the United States reclamation work. The first irrigation in the Southwest was done upon lands adjacent to Ysleta by the Pueblo Indians in the days of Cortez and other early Spanish explorers. The proposed electric line will handle the products of the irrigated farms and afford transportation service to the many people who have taken up homes in the valley. It is stated that the road has been amply financed. Contracts for construction materials and supplies will soon be let.

PROPOSED CORPORATION TAX.—The Chicago *Daily Tribune* publishes a table showing what the proposed corporation tax of 1 per cent of net earnings will mean to a number of Chicago corporations in the shape of annual payments to the United States Treasury. In the case of the Commonwealth Edison Company, for instance, taking the latest report of net earnings, the tax would amount to $12,419. Other electrical or allied companies would be taxed about as follows: Automatic Electric Company, $4,581; Chicago Railways Company, $33,111; Chicago City Railway Company, $25,649; Chicago Telephone Company, $20,733; Metropolitan West Side Elevated Railway Company, $2,614; Northwestern Elevated Railroad Company, $3,508; People's Gas Light & Coke Company, $27,556; Pullman Company, $87,889; South Side Elevated Railroad Company, $2,340. The railroads centering in Chicago would be, of course, large contributors to this tax. The largest would be the Chicago & Northwestern Railroad, which on the basis of the latest report would pay $136,386.

ISTHMIAN CANAL BIDS FOR ELECTRICAL SUPPLIES.—Bids will be opened in Washington on Aug. 10 by the Isthmian Canal Commission for various electrical apparatus. These supplies include bells, switches, push-buttons, plugs, fuses, porcelain tubes and insulators, lightning arresters, conduits, brackets and fixtures, contactors, trolley bases and wheels, batteries, motor brushes, bare and insulated wire and telephones. The proposals ask for bids on almost all sizes and kinds of electrical equipment. In another circular the commission invites bids, to be opened Aug. 18, for the following materials: two turbine pumps, 3-stage horizontal shaft, each arranged for direct connection to a 25-cycle, 440-volt induction motor, each pump to be capable of handling 1400 gal. of pure water against a friction and gravity head of 300 ft.; two induction motors to operate on a 3-phase, 440-volt, 25-cycle circuit and a combined three-panel switchboard, two panels for electrical instruments and controllers, the third for pump gages.

ELECTRICALLY EQUIPPED GRAIN ELEVATOR.—The large fireproof grain elevator of Mueller & Young, at Fifty-fifth Street and the Pennsylvania railroad tracks in Chicago, has been operated by steam engines with rope drive, but by a contract just concluded with the Commonwealth Edison Company it is to be equipped for electric drive throughout. Forty three-phase, 220-volt, 60-cycle alternating-current motors ranging in size from ½ hp to 75 hp will be required, and they will have a total rating of 700 hp. The driven machinery consists of elevator legs, conveyors, scouring machines, exhaust fans, hoists, car pullers, dust packers, vacuum cleaners and several other types of equipment found in modern grain elevators. One of the machines is an oat clipper, which requires a 75-hp motor to operate it. This elevator handles about 40 cars of grain daily, and the Commonwealth company has made a five-year contract to supply the energy to operate it.

EXHAUST STEAM TURBINES ORDERED BY THE INTERBOROUGH RAPID TRANSIT COMPANY.—The General Electric Company is building for the Interborough Rapid Transit Company of New York City two 5000-kw, low-pressure turbines, to be operated in connection with reciprocating engines of the same rating in the subway division power house on Fifty-ninth Street and Eleventh Avenue. The order hinges on the satisfactory performance of the 5000-kw unit now installed in the same power house, and which is now undergoing test. The turbines will be vertical machines driving 3-phase, 25-cycle, 11,000-volt induction generators, the leads from which will be connected without switching apparatus to the generators driven by the respective reciprocating engines. The turbines have no governors save for emergency use, and will be equipped with surface condensers.

KINGS COUNTY ELECTRIC LIGHT & POWER COMPANY.—The report of the Kings County Electric Light & Power Company, which includes the Edison Electric Illuminating Company of Brooklyn, for the six months ended June 30, 1909, shows a surplus, after the payment of charges and dividends, of $50,180. This is a decrease of $3,604 from the same period last year, although as a matter of fact the earnings were considerably greater. The difference is due to the fact that the operating expenses of the company were increased from $824,660 to $874,878, due to the system of accounting prescribed by the Public Service Commission.

WESTINGHOUSE INSTALLATION AT WORCESTER, MASS.—The Spencer Wire Company, of Worcester, Mass., has just contracted to duplicate its present installation of a Westinghouse 16-in. x 18-in. vertical gas engine, rated at 200 hp, and a 250-hp Westinghouse suction producer plant, to meet the needs of its factory. The engine will be directly connected to a 135-kw, 3-phase, 440-volt, 60-cycle alternator, similar to that now running. The initial equipment has been in use only a short time, and is representative of the most improved producer-plant practice for a modern output.

DENVER-GREELEY ELECTRIC RAILWAY.—C. H. Pierce, who has been promoting an electric railway to be run from Denver to Greeley and intervening cities, announces that, while the task of financing the proposition is progressing favorably, it has not yet been consummated. This summer is expected to see the completion of the financing and the beginning of actual construction. This will be a road some 56 miles in length, and energy will probably be purchased for its operation from some of the new water-power companies, the Central or the Eastern Colorado Power Company.

TROY STREET SUBSTATION, CHICAGO.—A contract has been closed for the erection of the new Troy Street substation of the Commonwealth Edison Company, Chicago, of which mention was made in the *Electrical World* of April 22, 1909. The building is located on South Troy Street, one block west of Kedzie Avenue and half a block north of West Twenty-second Street. It will house a step-down transformer substation of the usual type, the equipment consisting of two 1500-kw transformers.

ALLIS-CHALMERS 4,000-KW GAS-ENGINE UNITS.—The Allis-Chalmers Company has received a contract covering two 3-phase, 25-cycle, 6600-volt, alternating-current generators, with a combined capacity of 8000 kw, to be direct-coupled to gas engines in the power plant of the Carnegie Steel Company's Carries Furnaces at Rankin, Pa. These are stated to be the largest machines ever built for service of this character.

ELECTRICITY IN GUADALAJARA, MEXICO.—In discussing the effect on American trade of ordering all wires underground in Guadalajara, Consul Samuel E. Magil said that the order was the effect of the union of two strong local corporations, La Compañia de Tranvias, Luz y Fuerza de Guadalajara, with La Empresa Irrigadora y de Producción Electrica de Guadalajara. The former corporation now has a monopoly of the electric service of the city, and the latter corporation has valuable concessions from the State of Jalisco and the Government of Mexico, through which it controls rights to irrigate a large tract of land in the State and to immense water-power in near-by rivers, and also to enter Guadalajara with its wires to compete with the former in selling electricity in the city. This will prevent a possibly dangerous competition and will certainly result in benefit to Guadalajara, although prices will probably be kept up to the present standard. Just what opening this change will offer to American manufacturers is at present uncertain, because, while the Compañia de Tranvias has heretofore purchased American-made electric machinery, the Compañia Irrigadora is said to have made a contract with a large German concern to use German goods exclusively in return for financial aid given by the German company about a year ago, at a time when it was difficult to interest American capitalists in Mexican enterprises. Offerings of materials for the conduits and for the trolley underground addressed to either of the above companies will no doubt receive consideration, and may result in business.

MURALT & COMPANY, 114 Liberty Street, New York, have been awarded the contract for the electrical equipment of a new municipal lighting and pumping plant at Berlin, Md. Two-phase alternators generating at 2200 volts will be driven by gas engines supplied from producers. Distribution will be at 110 volts.

Financial Intelligence.

THE WEEK IN WALL STREET.

The past week in Wall Street has not been one of great importance, although stocks have been strong in tone and prices have generally advanced. Trading during the week was not particularly active, and the majority of the transactions were among the professionals. During the earlier days there was very little doing, but as soon as it became apparent that an end of the tariff uncertainty had been reached traders took heart and began to go into the market more freely. The feature of the week, from a financial point of view, was the report and increase of dividend of the United States Steel Corporation. The figures for the June quarter are considered to be very satisfactory. They show net earnings of $29,340,491, an increase of $6,419,233 over those of the March quarter and an increase of $9,074,735 over those of the same quarter in 1908. While this showing was regarded as satisfactory the report as to unfilled orders was taken to be even more encouraging. This showed that the corporation now had on hand orders for 4,057,939 tons of material, an increase of 515,344 tons over those of March 31 and of 744,063 over those on hand at the end of the June quarter in 1908. The increase in the dividend on the common stock from 2 to 3 per cent had been so long discounted by the ticker that it had no effect upon the price of the stock. The benefits to be derived from such increases are always reserved for the insiders, and when the price of common advanced 10 points within a few weeks without any apparent reason it was because those who knew what was coming were buying. The returns from the railroads continue to show increases in earnings over the same periods in 1908 and 1907. The amount of idle equipment is becoming less and less, and in some sections the roads are already beginning to complain of the difficulty of securing cars and locomotives sufficient for their purposes. This condition means that orders for new equipment must necessarily be forthcoming before long, and it is generally believed that when such orders start they will be quite liberal. Except for cotton, the reports from the crops are entirely favorable. It is now freely predicted that the farm yields throughout the West and Northwest will be considerably greater than the most sanguine estimates heretofore made, and will be by far larger, in volume and value, than any in the history of the country. All of this is taken to mean business for Wall Street. There is still a good demand for bonds, and money continues plentiful and cheap. Quotations on Aug. 2 were: call, 1¾@2 per cent; 90 days, 2¾@3 per cent. The quotations in the table are those of the close Aug. 2.

NEW YORK.

	July 26.	Aug. 2.	Shares sold.		July 26.	Aug. 2.	Shares sold.
All.-Ch.	15*	16¼	2,300	Int.-Met., pfd.	45	48	32,945
All.-Ch., pfd...	53	57	5,930	Mackay Cos...	82	84⅛	3,100
Amal. Cop....	82⅞	84¾	150,500	Mackay Cos.p.	73⅞*	74¾	300
Am. D. T.....	30*	30*	———	Man. Elev....	145*	144½	205
Am. Loc.....	62	67¼	17,400	Met. St. Ry...	20*	20*	300
Am. Loc., pfd.	120½	120¾	400	N.Y. & N.J.Tel	139⅞	142	2,390
Am. Tel.&Cbl..	84*	84*	———	Steel, com....	70⅛	74¾	487,175
Am. T. & T...	140¼	143¼	42,350	Steel, pfd....	126½	128½	22,650
B. R. T.....	77⅜	80½	25,570	W. U. T.....	73½	76	11,076
Gen. Elec.....	166¾	170	7,725	West'h, com...	84½	86	6,000
Int.-Met., com.	14¼	15½	10,711	West'h, pfd....	124½*	124½	100

PHILADELPHIA.

	July 26.	Aug. 2.	Shares sold.		July 26.	Aug. 2.	Shares sold.
Am. Rys.....	45½*	46	———	Phila. Elec....	11⅞	12⅜	———
Elec. Co. of A.	12⅝*	12¼*	———	Phila. R. T....	29	32⅛	———
Elec. St. B'ty.	56½	62	———	Phila. Trac...	90½*	90⅞	———
E. S. B'ty,pfd.	49*	49*	———	Union Trac...	53½	55⅞	———

CHICAGO.

	July 26.	Aug. 2.	Shares sold.		July 26.	Aug. 2.	Shares sold.
Chi. City Ry..	180*	180*	———	Chi. Tel. Co..	133	134	———
Chi. Rs.,Ser.1.	119	119½*	———	Met. El., com..	16*	16*	———
Chi. Rs.,Ser.2.	38	39*	———	Met. El., pfd..	47¼*	47¼*	———
Com. Edison...	120	120	———	Nat'l Carbon...	91*	92½	———
Chi. Sub'ws...	20¼	19½	———	Nat'l C., pfd..	119*	119*	———

BOSTON.

	July 26.	Aug. 2.	Shares sold.		July 26.	Aug. 2.	Shares sold.
Am. T. & T...	140¼	143¼	———	Mex. Tel.....	2¾*	2¾	———
Cum. Tel.....	137½*	145½*	———	Mex. Tel., pfd.	6*	6*	———
Edison E. Ill..	250	254*	———	N. E. Tel....	134	134	———
Gen. Elec.....	167	170	———	W. T. & T....	10¼*	12	———
Mass. E. Ry..	12	12⅝	———	W. T. & T., p.	86*	90	———
Mass. E. R., p.	73¾	72	———				

*Last price quoted.
Shares sold are for week July 26 to July 31.

DIVIDENDS.

Boston Elevated Railway Company, semi-annual, 3 per cent, payable Aug. 16.

Consolidated Gas Company, New York, quarterly, 1 per cent, payable, Sept. 15.

Lawrence (Mass.) Gas Company, semi-annual, 4 per cent, payable Aug. 2.

Northwestern Elevated Railroad Company, preferred, 1 per cent, payable Oct. 18.

Ohio Traction Company, Cincinnati, preferred, quarterly, 1¼ per cent, payable Aug. 1.

Pressed Steel Car Company, preferred, quarterly, 1¾ per cent, payable Aug. 25.

Susquehanna Railway, Light & Power Company, preferred, quarterly, 2½ per cent, payable Sept. 1.

POTOMAC ELECTRIC POWER COMPANY.—The annual report of the Potomac Electric Power Company, of Washington, for the year ended June 30 shows gross earnings from operations of $1,352,888 and total expenses, including maintenance, renewals and new construction, of $965,945. During the year the company issued bonds to the amount of $1,500,000, and paid in interest, sinking fund and taxes, $757,543, and in repayment of loans, $650,000. The balance on hand at the end of the year was $519,907.

CARS ON THE MANHATTAN BRIDGE.—The receivers of the Metropolitan Street Railway Company have been granted until Sept. 1 to file an amended petition for the right to run tracks over the new Manhattan Bridge. The company only wanted to run its tracks across the bridge, but Acting Mayor McGowan has ruled that they must be run all the way to Flatbush Avenue and Fulton Street or not at all. The delay was granted for the company to consider this situation.

CONSOLIDATED GAS COMPANY SELLS NOTES.—N. W. Harris & Company, of New York, have just purchased from the Consolidated Gas Company an issue of $5,000,000, 4 per cent, collateral trust notes due Aug. 10, 1910. The proceeds of these notes will be used to take up a like amount of 5 per cent notes due Aug. 10, 1909. The notes are secured by a deposit of $6,250,000 stock of the New York Edison Company.

WESTINGHOUSE RE-ELECTS DIRECTORS.—At the annual meeting of the stockholders of the Westinghouse Electric & Manufacturing Company, which was held in Pittsburgh July 28, the following directors were re-elected: Richard Delafield, E. C. Converse, Anthony N. Brady and J. D. Callery. The report was presented at this meeting, but only routine business was transacted.

AMERICAN TELEPHONE & TELEGRAPH CONSOLIDATION.—In connection with the movement to consolidate all the Bell operating companies into one big corporation, a bulletin has been issued from the Boston office of the American Telephone & Telegraph Company which says that the plan is too big to be disposed of within a few months' time and that it is a broad movement which in its complete unfolding will spread over a number of years. It is announced that no further exchange of American shares for the shares of local companies will be attempted until the results of the four offers already made have been worked out. The circular then says: "The first step was taken two years ago when the Bell of Philadelphia, the Pennsylvania, the Chesapeake and Potomac, the Delaware and Atlantic and the Diamond State companies, occupying adjoining territory, were consolidated. This consolidation was not completed until the end of 1908. The next step was bringing under a common management the large New York companies and the making of a practical consolidation of the companies operating in central New York. This step was completed this year. Although hampered by artificial boundaries the results of consolidations thus effected from both the economical and practical standpoints have been so great that a step further was decided upon in order that the maximum advantages could be obtained. That the closely interrelated territory of the New York & New Jersey, Bell of Philadelphia, Bell of Buffalo and Central District and Printing Telegraph Company of Pittsburgh might be more effectually rearranged the American Telephone & Telegraph Company offered an exchange of its shares for the outstanding local shares." The basis of exchange with the Bell Company of Buffalo was not one for one and a half, as announced, but was 15 shares of American for 16 shares of the local company.

ELECTRIC RAILWAY BUSINESS IN MASSACHUSETTS.—Returns from the Massachusetts Electric Companies for the quarter ending June 30 show an increase of about $47,000 in gross earnings as compared with the same period last year, representing a gain in traffic of about $50 per mile of track operated on these lines, which extend from Boston to Nashua, N. H., on the north and to Newport, R. I., on the south. A large part of this traffic originates in the less thickly settled districts, and as this system is peculiarly sensitive to the prosperity of the communities through which its cars are operated, the gain in earnings for the three months represents steady improvement in local business conditions. The warm weather has also undoubtedly induced extra travel by trolley. For the nine months ending June 30 the gross earnings increased $100,504. The management expended about $200,000 more upon maintenance in this period than in the corresponding one of last year, and the physical condition of the property is much improved. The dividend rate of 3 per cent upon the preferred stock remains unimpaired, and it is expected that the estimated increase of $100,000 in gross earnings for the present quarter may enable the dividend rate to be raised to 4 per cent next January.

TELLURIDE POWER COMPANY EXPANDING.—It has recently been made known that the Telluride Power Company, a concern which has hydro-electric plants at Telluride, Col., and Provo and Logan, Utah, is in reality the owner of the Beaver River Power Company. This company owns the water rights of the Beaver River in Utah, and recently completed and put in operation the first units of a power plant which will ultimately cost $900,000. The ownership by the Telluride company was disclosed through the sale by the Beaver River company, a couple of weeks ago, of $400,000 worth of bonds for completing its work. These bonds were purchased by the American Trust & Savings Bank and Cutting, Waller & Mayer, of Chicago. L. L. Nunn, president of the Telluride company, is also president of the Beaver River company, and the boards of directors of the two corporations are made up of the same men.

INTERBOROUGH RAPID TRANSIT EARNINGS.—Preliminary figures of the earnings of the Interborough Rapid Transit Company for the fiscal year which ended June 30, 1909, show a gross of $25,775,392 as compared with $24,059,299 in the previous year. The returns derived from the operations of the subway and the elevated lines after paying all charges were equal to 13.11 per cent on the $35,000,000 stock of the Rapid Transit Company. The net income for the year after all fixed charges have been paid amounts to $8,789,823. To these earnings the subway contributed $11,917,313, an increase of $1,896,774 over the previous year, and the net for the subway was $7,369,692, a gain of $1,772,468. The Manhattan Elevated lines earned the full amount of the 7 per cent guarantee which the Interborough has to pay.

WESTERN UNION TELEGRAPH EXPANDING.—In spite of the fact that the telephone as a method of communication has been cutting into the business of the telegraph companies, the Western Union considers that its particular field is open to further development, and the management is at the present time expending large sums on extensions and improvements. President Clowry has recently made the statement that July, up to date, had been better than any similar period in the history of the company. There is now available for dividends a balance of $5,447,663, or $3,766,917 more than was available at the same time in 1908. The total balance of the company at the present time is $17,102,075, which is $2,708,219 more than one year ago.

SOUTHERN COLORADO POWER & RAILWAY COMPANY.—The stock holdings of J. J. Henry, amounting to $36,000, in the Southern Colorado Power & Railway Company have been offered for sale on account of some hitch in the arrangement by which he controlled the company. In this connection it is announced that Mr. Mosely, who was formerly connected in an engineering capacity with the Central Colorado Power Company has been placed in charge of construction of the interurban line in the Grand Valley through Grand Junction. The Southern Colorado Power & Railway Company recently suffered a severe loss by fire in its power station at Trinidad, Colo.

TOLEDO RAILWAYS & LIGHT COMPANY.—Another appeal has been sent out by the secretary of the stockholders' protective committee of the Toledo Railways & Light Company, urging the shareholders to deposit their holdings with the committee. H. F. Swift, the secretary of the committee, says that while a majority of the stock has been deposited the work of the committee is being retarded by a number of small stockholders who are holding back. It is intimated that those stockholders who do not come in run a risk of losing their holdings.

GENERAL ELECTRIC ACTIVITY.—The prospects are that the orders of the General Electric Company for the current fiscal year will run in excess of $60,000,000. Earnings are also showing improvement, one reason being the low prices that prevail for copper. Moreover, the operating costs will probably show a sharp reduction. The increased business that has developed during the last several months is reflected in the stock quotation, which has exhibited a steady upward movement.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Elmira Water, Light & Railroad Company:					
Quarter ended March 31, 1909	$51,477	$37,954	$13,523	.....	.....
Quarter ended March 31, 1908	53,301	40,100	13,200	.....	.....
Lake Shore Electric Railway Company:					
June, 1909	95,825	48,784	47,041	$34,478	$12,562
June, 1908	90,662	51,561	39,100	31,267	7,832
Manufacturers' Light & Heat Company, Pittsburgh:					
Six months ended June 30, 1909	2,802,699	942,868	1,859,831	492,541	1,367,290
Six months ended June 30, 1908	2,492,552	964,298	1,528,254	546,483	981,771
Massachusetts Electric Companies:					
Quarter ended June 30, 1909	2,040,177	1,322,978	717,199	458,477	258,721
Quarter ended June 30, 1908	1,993,216	1,212,081	781,135	466,191	314,943
Norfolk & Portsmouth Traction Company:					
June, 1909	164,511	97,269	67,242	.....	.....
June, 1908	164,526	98,622	65,904	.....	.....
United Railways of San Francisco:					
June, 1909	597,484	344,800	252,684	.....	.....
June, 1908	551,193	347,037	204,156	.....	.....

GENERAL NEWS

Construction News.

BIRMINGHAM, ALA.—It is understood that the Tennessee Coal, Iron & Railroad Company, of this city, in connection with the other improvements it contemplates, is planning the construction of a generating plant, the cost of which will be several thousand dollars.

CITRONNELLE, ALA.—It is understood that a company is to be formed at this city for the purpose of establishing an electric-light plant. E. E. Nichols is reported to be the prime mover in the new enterprise, the plans for which indicate that the installation will be effected within ninety days.

PHOENIX, ARIZ.—The Consolidated Telephone Company is arranging for the installation of considerable new equipment in its exchange at this city.

CORNING, CAL.—A large pumping station, which will in all probability be operated by electricity, is to be established in the Maywood Colony by George Hoag, of Corning.

DORRIS, CAL.—A proposition has been made to the city of Dorris by Moore Bros., Klamath Falls, represented by Frank Rose, to furnish electricity for lighting and industrial purposes. It is planned by Moore Bros., who have applied for a 50-year franchise in Butte Valley to erect a $75,000 power plant on the Klamath River, and to construct transmission lines to Dorris, Macdoel and Mt. Hebron. It is believed that the carrying out of this project will mean the substitution of electric motors at all pumping stations throughout the Valley for gasolene engines which are now being used.

ESCONDIDO, CAL.—It is reported that an application for an electric-service franchise was recently filed with the City Council by Seth Hartley, of Colton, and that the sale of the franchise is set for September 14. In the interim, it is the intention of Mr. Hartley, so he states, to endeavor to secure three-year contracts from the people in Escondido to patronize his system exclusively, the immediate construction of the plant being contingent upon his success in this direction.

FLORENCE, CAL.—It is announced that the Board of Supervisors has passed a resolution calling for a meeting in this city on August 10, the purpose of such meeting being to vote on the establishment of a lighting district. Similar action is to be taken in East Hollywood.

JACKSON, CAL.—It is said that the Crystal Water Company, a new concern of which nothing definite is known in Jackson, has purchased all of the rights of the Oleta Canal & Power Company, including the Purington and Eagle ditches and other water rights in Dry Creek and Cosumnes River.

LODI, CAL.—The City Clerk, J. McMahon, writes that bids will be received until Aug. 14 for the purchase of bonds for waterworks, an electric light plant and a sewer system. H. Henderson, of Stockton, is engineer.

MERCED, CAL.—The South Fork Mining & Power Company, which owns the Peach Tree and Panoche group of mining claims, is preparing to construct a generating plant for its own use, it is said. As the plant is to be located in the forest reserve, it will be necessary for the company to make a detailed map of its proposed work for filing with the U. S. Government. Smith & Arnold, of Boston, are said to have charge of the property for the company.

SANTA CRUZ, CAL.—The Coast Counties Electric Light & Power Company is installing a 450-kw motor-generator with a rating of 535-hp. This new apparatus is being added to supply power for the Union Traction Company, and is expected to double the equipment of the latter company's plant.

COLORADO SPRINGS, COL.—H. F. Avery, Mayor, is reported to be in favor of constructing an electric-light plant to utilize the water power now going to waste on Pike's Peak.

RIFLE, COL.—The town is installing an electric-lighting plant, which should be in operation by the last of the year.

HARTFORD, CONN.—The Hartford Electric Light Company has declared its regular quarterly dividend of 2 per cent, and an extra ½ per cent.

MIDDLETOWN, CONN.—Arrangements are under way for a betterment of the street lighting in Middletown, the improvement involving the substitution of tungsten lamps for arc lamps wherever possible.

TORRINGTON, CONN.—A 500-kw Westinghouse-Parsons turbine generator set is being added by the Torrington Electric Light Company to its station equipment. The station supplies a lighting and industrial service with 60-cycle, three-phase current at 2300 volts.

WASHINGTON, D. C.—Separate bids will be received until Aug. 11 by Bernard R. Green, superintendent of buildings and grounds, for furnishing and delivering the distributing switchboard and feeder panel, conduit and fittings, automatic time switches and wire for the electric system of illumination in the court book stack of the building for the library of Congress.

FORT PIERCE, FLA.—We are advised by the St. Lucie Ice Company that it has refused the franchise recently granted by the City Council on account of a 10-year clause.

JACKSONVILLE, FLA.—A meeting has been called for August 16 by the Jacksonville Electric Company, of which Clement R. Ford is secretary, for the purpose of voting on a $400,000 increase in its capital stock.

LEESBURG, FLA.—It is announced that J. Y. Clark, manager of the Leesburg Ice Company, who was recently granted a franchise for an electric-light system and waterworks at this city, has placed a contract with the Chicago Bridge & Iron works, Chicago, for an 80,000-gallon tank, and ordered a generator and engine from the Skinner Engine Company, Erie, Pa.

PENSACOLA, FLA.—The Board of Public Works has decided to install electric lamps on Palafox Street from Gonzales Street north to the city limits, a distance of about twenty blocks, and the Pensacola Electric Company has been authorized to proceed with the work.

BREMEN, GA.—It is stated that the City has engaged W. J. Radcliffe, Tallapoosa, Ga., to superintend the construction of the electric-light plant to be installed at Bremen, for which purpose the citizens recently voted to issue $8000 in bonds.

ELBERTON, GA.—The report of Park A. Dallis, engineer, of Atlanta, Ga., for increasing the equipment of the municipal electric-lighting plant having been approved by the City, it will install a 300-hp generator, increase water power by lowering tailrace, remove and install present generator at pumping station, where it will be connected with engines used for pumping water, and construct a practically new line from the electric plant to the city. A bond issue of $5,000 was recently authorized to carry on this work.

MOUNTAIN HOME, IDAHO.—It is reported that the Crane Falls Power & Irrigation Company, a Canadian and Cleveland corporation, is planning to construct west of Mountain Home a power plant the estimated cost of which is $15,000. R. P. Chatton, of this city, is interested in the proposition.

AURORA, ALL.—A franchise has been granted by the City Council to the Aurora, Elgin & Chicago Railroad to construct an electric railway through Aurora.

CARPENTERVILLE, ILL.—The City Council has granted to the Elgin, Woodstock & Lake Geneva Railroad a 50-year franchise to operate a street railway through Carpenterville, the provisions of which are that the company shall complete the railway within a year, and file a bond of $10,000 within 60 days after the passing of the ordinance. J. A. Kirkland, of Elgin, is among those interested in the company.

CHENOA, ILL.—The Joliet & Southern Traction Company, of which Lee Fisher is electrical and chief engineer, has applied to the City Council for permission to enter Chenoa.

CHENOA, ILL.—C. C. McDonald, owner of the present electric-light plant, is said to have secured a 10-year franchise, and is planning to construct a new plant on the west side of Block 25, Hamilton addition, to install new lamps and make the system generally as perfect as possible.

GALESBURG, ILL.—A 25-year franchise to construct and operate an electric railway in this city has been granted to the Peoria & Galesburg Railway, of which S. F. Atwood is secretary.

GENOA, ILL.—A 50-year franchise to construct a street railway in Genoa has been granted by the City Council to the Woodstock & Sycamore Traction Company.

KANKAKEE, ILL.—The Kankakee Electric Railway has been granted a 20-year franchise to extend its electric railway lines on certain streets of Kankakee.

OREGON, ILL.—The capital stock of the Oregon Power Company has been increased from $150,000 to $300,000.

QUINCY, ILL.—Contracts for the construction of an electric light and power plant for the Illinois Soldiers and Sailors' Home, bids for which were opened July 23, have been awarded as follows: To the Ball Engine Company, of Erie, Pa., for engines; alternators to the Electric Machine Company, of Minneapolis, Minn.; boilers (Stirling) to Stack & Kellogg; piping and covering to E. Best, of Quincy, Ill., and Kohler Brothers, of Chicago, Ill.

ANDREWS, IND.—It is the intention of the Andrews Electric Light Company to remodel and enlarge its power station, and to add considerable new machinery and equipment. For this purpose it will be necessary for the company to discontinue its service for several weeks, due notice having been given to its customers.

AURORA, IND.—The City Council has granted the Engineering & Equipment Company a franchise to build, own and operate a freight and passenger railway in this place and to connect with Rising Sun, Ind., The company will purchase oil engines, generators, storage batteries and railway supplies in the near future.

HARTFORD CITY, IND.—The Hartford City Lighting Company, which is controlled by the Trowbridge & Niver Company, a Chicago bond

house, is applying for an extension of its franchise from 15 to 25 years. As stated before, other plans are under consideration, pending this extension, which contemplate the consolidation of the electric lighting and industrial supply in several towns in the vicinity, and the erection of a large plant at Hartford to supply energy to these towns.

INDIANAPOLIS, IND.—A proposition to light all the downtown streets without cost to the city has been made by the Peacock-Wooley Lighting Company, a Chicago concern. The company reserves the right to place advertising matter on the glass panels of the lamp posts, out of which it will derive its revenue. The city officials claim that the scheme will effect a saving of $10,000 a year, and a test installation is to be put in operation in a few days.

MISHAWAKA, IND.—The City Council has passed an ordinance requiring the new Electric Light Company and the Bell Telephone Company to place their wires underground at once. The Home Telephone Company has already installed a conduit system.

PORTLAND, IND.—The City Council is reported to have awarded the Ames Iron Company, of Cleveland, the contract for furnishing a complete new equipment for the municipal electric light and power plant.

SOUTH BEND, IND.—It is the intention of the Indiana & Michigan Electric Company, of which F. A. Bryan is manager, to install a new system of electric lighting in the business section of the city, for which purpose tungsten lamps in clusters will be employed.

ESTHERVILLE, IA.—We are advised by G. C. French, superintendent of the Municipal Electric Light Plant at this city, that a day service is about to be inaugurated in Estherville, two new Fort Wayne three-phase, 60-cycle alternators having just been installed to take the place of the old Fort Wayne single-phase, high frequency machines. The company is starting with seven motors, ranging from 1 hp to 15 hp.

GRINNELL, IA.—Reports are current that it is the intention of the Grinnell Electric & Heating Company to expend about $7,000 in the improvement of its plant at this city.

PETERSON, IA.—The citizens of this place have voted to install an electric-light plant, and plans are under way for the formation of a company which will eventually render a lighting service to Sutherland as well as to Peterson. Mr. Sitz, of the latter city, is the prime mover in the new enterprise.

CHERRYVALE, KAN.—It is reported that the Cherryvale Electric Light & Power Company contemplates increasing the equipment of its plant.

DODGE CITY, KAN.—The Midland Water, Light & Ice Company, so we are informed by W. Watson, secretary and superintendent of the company, expects to install a gas producer and engine.

PITTSBURGH, KAN.—It is reported that the Pittsburgh & Kansas City Railway Company expects to erect a power station near Franklin, Mo.

TOPEKA, KAN.—It is confidently expected that the municipal lighting plant will be able to resume its lighting service at an early date. The system has been thoroughly overhauled and new equipment has been installed, and it is understood that the equipment of the plant has been practically doubled. In anticipation of the increased facilities, petitions for additional lamps in the various wards of the city are being filed by the respective councilmen of such wards.

WAKEENEY, KAN.—The citizens on July 26 voted to issue $30,000 in bonds for the construction of a water works system and $10,000 for an electric light plant. George P. Taylor, of Stockton, Kan., is engineer.

MADISONVILLE, KY.—All the bids recently received for machinery for the municipal electric-light plant are reported to have been rejected and new bids will be received; probable cost, $7,000.

NEWPORT, KY.—A twenty-year franchise has been granted by the City Council to the Citizens' Telephone Company, which will at once commence work on the installation of its conduit system.

WEST PEMBROKE, MAINE.—A 100-lamp electric plant has been installed by the Sunset Packing Company in its factory at this city.

BERLIN, MD.—It is announced that Muralt & Company, engineers of New York City, have been awarded the contract for furnishing and installing the electrical equipment of the new municipal lighting and pumping plant. Energy will be generated and transmitted throughout the city by means of a 2200-volt, two-phase alternating current system. Step-down transformers, reducing the potential to 110 volts, will be provided at the centers of distribution, from which the city lighting circuits will be fed.

THURMONT, MD.—Mayor Freeze, of Thurmont, Md., and L. R. Walsche are interested in a project for the installation of a lighting plant for the city of Thurmont. It is understood that rights-of-way have been secured along Hunting Creek near Thurmont for a pipe line, which is planned to be part of a water-power system for the operation of this plant. Estimates are being secured for the work, and it is the idea of those interested to have the plant large enough not only to furnish electricity for lighting the city streets and the residences, but also to supply energy for the operation of manufacturing plants as well.

CHARTLEY, MASS.—The Norton Electric Light & Power Company, of this city, has applied for permission to extend its transmission lines to Norton.

WILLIMANSETT, MASS.—The city of Willimansett is considering the advisability of installing an electric-lighting system.

MASON, MICH.—The Mason Electric Light & Water Works, of which F. J. Rapp is superintendent, advises that it expects to install a new dynamo and other machinery.

HAWLEY, MINN.—Bids will be received until Aug. 13 by the village clerk for the construction of an electric light plant and water works system, to include brick or concrete buildings, a 50,000-gal. steel tank and tower or air compressor tank and concrete reservoir, distributing pipe-line system, dynamo, switchboard and pole line wiring; also pumping plant. Oscar Claussen, of St. Paul, Minn., is engineer.

MINNEAPOLIS, MINN.—It is stated that the city authorities are willing to grant to the Northern Heating & Lighting Company the franchise for which it has made application, provided it will deposit a cash surety to the amount of $25,000 that it will carry out all the agreements it makes.

PARK RAPIDS, MINN.—The Power Engineering Company, Corn Exchange Building, Minneapolis, Minn., secured the contract from L. H. Rice, of St. Paul Rapids, for the construction of a complete new hydro-electric plant, consisting of a reinforced concrete flume, head race and power house.

CLINTON, MISS.—It is stated that the Business Men's League of this city is interested in a proposition to construct an electric railway between Clinton and Jackson. R. H. Henry is chairman.

CLARKSVILLE, MO.—Reports are in circulation to the effect that a company is to be organized at this city for the purpose of installing an electric-light plant. E. N. Moody is secretary of the committee in charge.

KANSAS CITY, MO.—The Southern Wyoming Power Company has signed contracts for the building of a dam, transmission line and power station at a point on the Laramie River about thirty miles southeast of Laramie. The company, whose headquarters are at Kansas City, Mo., is capitalized at $500,000, and about 1000 hp will be developed. The immediate market will be in the City of Laramie in competition with an old and inefficient steam plant located within the city limits. The possible development is very much greater than this, and the field will probably be extended later. The voltage is not yet determined and the machinery is not yet specified. Work on the dam and transmission line will be rushed, as the company is planning to furnish electricity for light to Laramie by Nov. 1.

MONETTE, MO.—Specifications are on file (for reference only) at the office of the Electrical World, 239 W. 39th Street, New York, N. Y., for furnishing material and machinery necessary for an electric-light plant at Monette, Mo., bids for which will be received by D. S. Breece, city clerk, until Sept. 1, 1909. The material required is as follows: Corliss engine, directly connected to alternating-current generator, with high-speed automatic engine, directly connected to alternating-current generator, each complete with independent exciters and controlling apparatus, switchboard, arc regulators, arc lamps, poles, wire, tungsten lamps complete, three tubular boilers, feed pump and feed-water heaters.

SEDALIA, MO.—The City Council has approved the bids for lighting Sedalia, recently submitted by the Sedalia Light & Traction Company, and an ordinance has been passed awarding that company a 10-year contract.

CENTRAL CITY, NEB.—C. F. Neumeyer, city clerk, advises that the citizens voted on July 20 to issue $18,000 in bonds for the construction of a lighting plant.

FAIRBURY, NEB.—The Fairbury Telephone Company has decided to combine with the Lincoln Telephone Company in the construction of three copper circuits between Fairbury and Beatrice, and also to build an additional line between Fairbury and Lincoln. It is estimated that the proposed extensions will represent an expenditure of about $10,000, which amount is to be equally divided between the two companies.

NEWARK, N. J.—The Clark Thread Company, of this city, is planning the substitution of electricity for steam in the operation of its plant. In connection with this change, it is understood that the company will arrange its motive power so that each mill can be run independently, enabling it to shut down one section of its plant in case of accident without interfering with the other mills.

ARTESIA, N. M.—Press reports state that the Farmers' Electric Light and Power Company has awarded the contract to install an electric light and irrigation plant on the edge of the artesian belt in Pecos Valley, near Artesia, to the Buckeye Engine Company, Salem, O.

FT. WINGATE, N. M.—Bids will be received by the Construction Quartermaster, U. S. A., until Aug. 18, for electric wiring the post exchange and gymnasium.

ALBANY, N. Y.—The Hoosic River Electric Light & Power Company has been granted the franchise for which it recently filed an application with the Second District Public Service Commission permitting it to operate in the village of Valley Falls. As stated previously, it will furnish electricity for lighting to Johnsonville and take over the present lighting system in Schaghticoke.

ALBION, N. Y.—It is stated that the contract for furnishing electricity for the buildings and grounds of the Western New York House of Refuge for Women at this city has been awarded to the A. L. Swett Light & Power Company, of Medina, that company having extended its transmission lines to the western boundary of the city.

FALCONER, N. Y.—The Falconer Electric Light Plant, of which W. E. Cowden is owner, is now erecting additional wires throughout the village, and is about to furnish 24-hour service from its station.

GLENS FALLS, N. Y.—Plans are being considered by the Commercial Association of this city looking toward the installation of flaming arc lamps in front of every store on the main business thoroughfare.

HUDSON, N. Y.—Bids will be received by Charles H. Strong, president of the board of managers of the New York State Training School for Girls, Hudson, N. Y., until Aug. 14 for construction of a new power house and trunk conduit.

MINEOLA, L. I., N. Y.—The Public Service Commission at Albany has authorized the Nassau & Suffolk Lighting Company to issue its preferred 6 per cent capital stock to the amount of $430,000, the proceeds to be used for extensions and improvements of its plant and distributing system. E. H. Mather is general manager.

MOHAWK, N. Y.—Newspaper reports state that a resolution has been adopted to appoint a committee, which shall consist of the Municipal Commission and two citizen members to investigate the cost of installing a municipal electric-light plant in Mohawk.

ALBERMARLE, N. C.—We are informed that the citizens voted July 27 to issue bonds to construct water works, electric light plant and sewer system. As yet no engineer has been selected. I. B. Miller is mayor.

CHARLOTTE, N. C.—It is the intention of the Decotah, Nokomis & Winonah Cotton Mills, of Lexington, to substitute electricity for steam in the operation of its plants, and with this end in view a contract has been entered into with the Southern Power Company, of Charlotte, for, approximately, 2000 hp.

COLUMBUS, OHIO.—A new exchange building is being erected in Columbus by the Cuyahoga Telephone Company, in which much new equipment is to be installed.

COLUMBUS, OHIO.—A new condenser for its Mound street plant and a new engine and generator for the North Side plant are to be installed by the Columbus Railway & Light Company.

FAYETTE, OHIO.—C. D. Hause, village clerk, writes that bids will be received until August 28 for an electric-light plant. He also states that the village will contract to furnish not less than twenty 2000-cp street lamps.

TIFFIN, OHIO.—The plant of the Tiffin Home Telephone Company has been sold by Receiver J. C. Royer to E. Bruce Myers, of this city, the consideration being $30,000.

WAGONER, OKLA.—It is stated that the City will vote in August on the issuance of $200,000 of bonds, the proceeds of a portion of which will be used for a municipal electric-light plant and waterworks. Address the Mayor.

BAKER CITY, OREGON.—The City Council has granted a franchise for a street railway in Baker City to Anthony Mohr.

LEBANON, OREGON.—A new dynamo is to be installed at the plant of the Lebanon Electric Light & Water Company, which will enable it to furnish a day service in this city.

TILLAMOOK, OREGON.—It is understood that the Tillamook Lumber Manufacturing Company is planning to furnish a lighting service to the business houses on the principal streets of this city.

PANAMA.—Bids will be received until August 10 by Capt. F. C. Boggs, Corps Engineer, U. S. A. Isthmian Canal Commission, Washington, D. C., for furnishing electrical material, including fixtures, fittings, batteries, cable, wire, line material, conduit, etc., as per Specification No. 526.

McKEESPORT, PA.—It is stated that construction work is soon to be commenced on the proposed street railway between McKeesport and Port Vue. The Realty Company, of McKeesport, is promoting the project, and it is planned eventually to extend the line to Clairton and Elizabeth. The officers of the company are: James F. Woodward, president; Israel A. Simon, secretary and treasurer; Thomas W. White, engineer.

MERCER, PA.—It is reported that Owsley & Baucherle, of Youngstown, Ohio, have been selected to prepare plans for a generating station which the County Commissioners will erect at Mercer, at a probable cost of $14,000.

PITTSBURGH, PA.—It is understood that the City Council has passed an ordinance providing for the construction of an electric light plant at the South Side Pumping Station, the estimated cost of the work being $4,000. Bids will be received by A. B. Sheppard, director Bureau of Water, Municipal Bldg., between August 1 and 15.

PITTSBURGH, PA.—The Duquesne & Dravosburg Railway Company, with headquarters at Pittsburgh, expects to commence construction work on its double-track electric railway from Duquesne to Dravosburg within a few weeks. The company is capitalized at $50,000, and the officers are: Fred W. Scott, 1351 Annex, Pittsburg, president; J. C. Cato, Aliquippa, vice-president; A. J. Krill, Aliquippa, treasurer. Douglas & McKnight, Union Bank Building, Pittsburgh, are the engineers.

CANONCHET, R. I.—It is the intention of L. Edwards, who is erecting a new building at this city in which is to be installed a dynamo, to light his factory by electricity.

HAMILTON, R. I.—The Sea View Railroad Company has installed in its power station at this city two 400-kw Westinghouse-Parsons turbines driving three-phase, 60-cycle, 360-volt alternators. This addition to the company's present equipment was installed for the purpose of supplying additional power to railway lines, and for furnishing electricity to light several adjoining towns, including Narragansett Pier and Wickford, R. I.

NORTH SMITHFIELD, R. I.—At a meeting of the citizens, for the purpose of voting on the installation of an electric-lighting system in North Smithfield, it was decided to instruct the town council to make a one-year contract with the Woonsocket Electric Machine and Power Company to light the streets of the town. An appropriation of $12,000 was voted.

PROVIDENCE, R. I.—It is understood that plans are being considered for the installation of new magnetite open arc lamps in the principal squares of the city. A saving of something like $9,000 having been effected under the new schedule of rates recently put into effect by the Narragansett Electric Lighting Company, such a system of lighting will be made possible without the necessity of asking for an extra appropriation.

BINGHAMTON, TENN.—The Binghamton Light & Power Company W. M. Tucker, manager, notice of whose intention to increase the equipment of its plant was recently published, expects to install a 150 or 200-kw generator, with boiler and engine, early in September.

LEXINGTON, TENN.—It is stated that the city is considering the construction of an electric-light plant and waterworks at a cost not to exceed $15,000, and that detailed information concerning the proposition may be obtained by addressing H. E. Graper.

ALVORD, TEX.—It is reported that E. E. Gose, of Decatur, Tex., is considering the installation of an electric-light plant at Alvord.

LUBBOCK, TEX.—The Lubbock Light, Ice & Power Company, notice of whose incorporation we published recently, expects to erect a $2,000 brick building in which will be installed a 75-kw alternating-current, 1100-volt, single-phase unit. R. B. Ellis is general manager of the company.

RANDOLPH, VT.—It is understood that competitive bids for a lighting and industrial service in this city will be considered by a committee to be appointed to investigate the subject of rates, quality of service, the White River Electric Company at the present time furnishing electricity for lighting the city, and it is probable that the Consolidated Lighting Company will be a competitor, as that concern has been asked to make a proposition to furnish energy to Randolph.

RUTLAND, VT.—A franchise to operate in this city having been granted by the City Council to the Home Telephone Company, work on the installation of its system is expected to be commenced at an early date.

BESSIE, VA.—It is stated by C. M. Crawford, Ironton, O., secretary of the Russell-Prater Railway Company, notice of whose incorporation was recently given, that its proposed lines are to be operated by steam and not by electricity, as previously stated.

BIG STONE GAP, VA.—Plans are being considered by capitalists represented by Alexander McD. Allenton, Toronto, Ont., Can., for the construction of an electric railway connecting the agricultural districts of Lee County with the Wise coal fields, energy to be furnished from the Powell River at a point near Jonesville.

RICHMOND, VA.—The Council Commission on Electricity recommended on July 27 to the Council for adoption the award of contract for electrical machinery for the municipal plant to Hotchkiss & Gordon, local agents of the General Electric Company, the only bid received on July 21; cost, about $96,000.

ROSLYN, WASH.—Final surveys are being made by the Cle Elum-Roslyn Railway & Power Company for its proposed electric railway line from Roslyn to Cle Elum, via Jonesville, a distance of about 17 miles.

CHARLESTON, W. VA.—Work is to be commenced at once by the Southern Bell Telephone Company on a long-distance line between this city and Madison.

GRAFTON, W. VA.—The Winding Gulf Colliery Company, of Cincinnati, which owns 3,300 acres of land on the Winding Gulf creek, is planning for the construction of a large power plant at that place, to be used in connection with the development of its mines.

MASONTOWN, W. VA.—The Tri-State Telephone Company's exchange at this place has been destroyed by fire.

WHEELING, W. VA.—The Wheeling Rapid Transit Company, of which A. M. Schenk is president, has applied to the Board of Commissioners for permission to operate an electric railway through Ohio County.

WHEELING, W. VA.—It is understood that arrangements have been concluded, although the agreement has not yet been signed, whereby the National Telephone Company, of this city, will take over the properties of the Youngstown Telephone Company and the Columbiana County Telephone Company. The new owners contemplate the expenditure of $350,000 in the extension and improvement of the two plants.

SHERIDAN, WYO.—Plans are being considered by the Rocky Mountain Bell Telephone Company for the construction of a new toll line from Sheridan to Basin, a distance of about 106 miles.

VANCOUVER, B. C., CAN.—The British Columbia Electric Street Railway Company has applied for 30,000 miner's inches from Indian River, and proposes to build an auxiliary power plant on Burrard inlet. Address R. H. Sperling, Vancouver, B. C.

WINNIPEG, MAN., CAN.—M. Peterson, secretary of the civic board of control, will receive sealed tenders until 11 a. m. Aug. 11 for the following supplies: 20,000 ⅝ by 12 in. carbons; 50 alternating-current series enclosed arc lamps; 50 absolute cut-outs.

WINNIPEG, MAN., CAN.—It is understood that the time in which bids will be received for the hydraulic, electric and auxiliary equipment required for the generating station at Point du Bois will be extended

until August 16. For plans, etc., apply to Smith, Kerry & Chase, engineers, Winnipeg; William Kennedy, Jr., Y. M. C. A. Bldg., Montreal, or M. Peterson, secretary, Board of Control, Winnipeg.

DUNDAS, ONT., CAN.—During a recent electrical storm at this city the transformer station of the Hamilton Cataract Power, Light and Traction Company was struck by lightning, completely destroying a good part of the apparatus. It is estimated that the company's loss will be in the neighborhood of $10,000.

DUNDAS, ONT., CAN.—The County Council has granted permission to the Hamilton Cataract Power, Light and Traction Company, of which W. C. Hawkins is general manager, to erect a transmission line on the highway from Horning Mountain to Dundas, in order to supply energy in that city.

NIAGARA FALLS, ONT., CAN.—The Cataract Power & Conduit Company, Buffalo, N. Y., of which De Lancy Rankine, 718 Fidelity Trust Bldg., is secretary and treasurer, expects to build a station at Niagara Falls, Ont., the estimated cost of which is $100,000.

TORONTO, ONT., CAN.—On account of failure to comply with the conditions imposed, seven leases of water-power rights have been cancelled by the Government. They are as follows: Mississaga River at Grand Portage, held by Joseph Allan Powers; the Seine River above Sturgeon Falls, Rainy River District, held by L. A. Demainville and G. H. Hillyer; Canal Rapids in the Magnetawan River, leased by the McKenzie Power & Development Co.; Deux Rivieres on the Ottawa River, leased to Joseph Kilgour, Willard Woodruff and others; a franchise granted to the Town of Webbwood, at Birch Falls on Birch Creek; Steep Rock Falls on the Seine River, leased to W. H. Upham and others, and a power on Long Lake River, leased to Frederick Bolton.

MONTREAL, QUE., CAN.—It is stated that the Montreal Light, Heat & Power Company is preparing to abolish the system of primary and secondary charges for electric lighting, which has proved so unsatisfactory, and to substitute a flat rate at a figure somewhat lower than in the past.

QUEBEC, CAN.—The Quebec Railway, Light & Power Company, of which E. A. Evans is general manager, is installing a 1000-kw motor generator.

WESTMOUNT, QUE.—Bids will be received until September 1 for $435,000 of bonds, a portion of which is to be used for the extension of the electric light plant.

MEXICO, MEXICO.—The Compania Electria y Irrigadora, of the State of Hidalgo, is preparing to install a generating station at Tetepango costing $2,000,000, which is to be finished in about one year.

New Industrial Companies.

THE BLISS-HEINKE MANUFACTURING COMPANY, New York, has been incorporated, among other things, for the purpose of dealing in patents and patent rights. It has a capital stock of $10,000, and the incorporators are: Frederick W. Bliss, East Orange, N. J.; Frederick Kopper, Jr., No. 10 Wall Street, New York, and Charl S. Brown, 36 Park Row, New York.

THE CAMPBELL ELECTRIC COMPANY, Lynn, Mass., has filed articles of incorporation and expects to manufacture and sell electric motors, dynamos and other electric machinery. It has an authorized capital stock of $20,000, and the following officers have been elected: President, Charles E. Campbell, 74 Jefferson Street; secretary, F. R. Campbell, same address; clerk, A. M. Rich, 276 Chatham Street, all of Lynn.

THE DAYTON ENGINEERING LABORATORIES COMPANY, Dayton, O., has been incorporated, with a capital stock of $150,000, by George W. Shroyer, Ellis P. Legler, Charles R. Nevin, H. H. McGrew and B. F. McCann. The purpose of the organization is to manufacture electrical and mechanical appliances.

THE EASTERN STORAGE BATTERY COMPANY, Chelsea, Mass., capitalized at $50,000, has filed articles of incorporation. Those interested in the new concern are: George H. Buck, president; David C. Buck, treasurer, both of 57 Nicholas Street, Chelsea; Franklin S. Evans, Chelsea, and Charles F. Rowley, 25 Pemberton Square, Boston.

THE ELECTRICAL INSTALLATION COMPANY, of New York, N. Y., has been incorporated to engage in electrical work of all kinds. It has an authorized capital stock of $20,000, and the incorporators are: William C. Pratt, 30 Pine Street; Arthur J. Pares, 51 W. 106th Street, and P. J. Eder, 80 William Street, all of New York.

THE FINKBEINER TURNEY COMPANY, Freeport, Ill., has been incorporated with a capital stock of $25,000 for the purpose of manufacturing engines and electrical supplies. The incorporators are: J. C. Finkbeiner, F. L. Turner and E. J. Kane.

THE INTERNATIONAL BURNER COMPANY, Brooklyn, N. Y., which has an authorized capital stock of $50,000, has been incorporated for the purpose of manufacturing machinery, tools and supplies relating to electricity, gas or steam. Those interested in the enterprise are: Henry Niemann, 163 Ralph Street; Anthony J. Ibert, 405 Evergreen Avenue, and John S. Averill, 449 Evergreen Avenue, all of Brooklyn.

THE McKEEVER ELECTRIC COMPANY, of Columbus, Ohio, which is a reorganization of the McKeever Electric Company, has filed articles of incorporation. It is capitalized at $50,000, and the following officers have been elected: Charles E. Munson, president; George McKeever, vice-president and general manager; Clarence F. Metcalf, secretary; Robert J. Wheaton, treasurer.

THE NATIONAL ELECTRIC SPECIALTY COMPANY, Toledo, Ohio, has been incorporated, with a capital stock of $15,000, to manufacture electrical supplies. The incorporators are: Chris. F. Wall, L. L. D. Chapman, E. B. Marshall, Samuel Kohn and William C. Cole.

THE RELIANCE AUTO-PARTS COMPANY, New York, N. Y., has been incorporated, with a capital stock of $20,000, by Herman L. Wilkens and J. H. Wilkens, 211 W. 40th Street, and W. R. Schaut, 38 W. 18th Street, all of New York. It contemplates, among other things, the manufacture of engines, motors, etc.

THE SHARPE TIRE-PROTECTION COMPANY, Brooklyn, N. Y., has been incorporated to control and grant licenses to patents of G. W. Sharpe relating to automobiles, etc., and to manufacture motor-boats, automobiles, etc. It has an authorized capital stock of $150,000, and the incorporators are: George W. Sharpe, 862 Sterling Place; William S. Hurley, 16 Court Street, and S. S. Whitehouse, 164 Montague Street, all of Brooklyn.

THE STANDARD TRUCK MANUFACTURING COMPANY, 419 Market St., Camden, N. J., has been incorporated, with a capital stock of $250,000 by F. R. Hensell, G. H. E. Martin and John A. MacPeak, all of Camden, N. J. It is the intention of the new concern to conduct a mechanical and electrical engineering business.

THE STEVENS-SOWERS MOTOR-CAR COMPANY, Boston, Mass., has filed articles of incorporation, its purpose being to manufacture and sell motors of all kinds. The capital stock is placed at $12,000, and those responsible for its formation are: James W. Stevens, who is president and treasurer, and Wheaton Kittredge, both of 18 Tremont Street, Boston.

Company Elections.

FRANKLIN, MASS.—The Franklin Electric Company has elected the following directors: J. F. Bartlett, C. W. Hazleton, Porter Farwell, E. I. Cassidy and C. W. Schuler.

LYONS, N. Y.—The following directors have been elected by the Wayne County Electric Company: C. D. Beebe, Henry D. Brewster, C. A. Lux, F. C. Eddy and N. C. Beatty, all of Lyons.

LYONS, N. Y.—At the annual meeting of the stockholders of the Wayne-Monroe Telephone Company the following officers were elected: President, Charles A. Lux; vice-president, George F. Waters; secretary and treasurer, Charles H. Towlerton.

LACONIA, N. H.—At a meeting held at this city the following officers and directors were elected by the Winnipesaukee Telephone Company: President, Jasper N. Keller; vice-president, F. W. Storey; treasurer, E. S. Willard; directors, J. N. Keller, F. W. Storey, F. S. Houston, J. B. Morrill, C. W. Vaughn, W. F. Knight, N. B. Jones, C. W. Adams and C. T. Keller.

PATERSON, N. J.—The following officers and directors were elected by the Paterson, Passaic & Suburban Telephone Company at its annual meeting: H. R. Schwartz, Trenton, treasurer; J. W. Lindsay, Paterson, secretary; Wayne Dumont, Paterson, counsel; directors, George A. Post, J. W. Lindsay, Wayne Dumont; B. G. Hamill, R. P. Wilson, B. Gummere, W. S. Hancock, E. C. Stokes, H. R. Schwartz, C. W. Rice, R. C. Chanmerlin, F. R. Demarest and R. Morrell.

TRENTON, N. J.—The following officers have been elected by the Union Railway, Gas & Electric Company, which recently filed incorporation papers at this city: Anton G. Hodenpyle, president; Clarence M. Clark, vice president, and George E. Hardy, secretary and treasurer.

TROY, N. Y.—At its annual meeting, held at this city, the Commercial Union Telephone Company elected the following officers: President, James H. Caldwell; first vice-president, Wm. Connors; second vice-president, Irving H. Griswold; secretary and general manager, E. L. Grauel; treasurer, Peter McCarthy.

HARRISBURG, PA.—At a meeting held at this city the West Shore Telephone Company elected the following officers: Ellis L. Orvis, Bellefonte, president; Jacob Reiff, New Cumberland, vice-president; E. H. Greenwood, Camp Hill, secretary and treasurer.

New Incorporations.

BIRMINGHAM, ALA.—The organization of the Birmingham & Edgewood Electric Railway Company, of this city, has been perfected by the election of the following officers: Stephen Smith, president; George H. Harris, first vice-president and general manager; M. A. Miller, second vice-president; G. T. Brazelton, secretary and treasurer. The purpose of the new concern is to construct an electric railway from the South Highlands line to Red Mountain.

MERIDEN, CONN.—The Meriden, Middletown & Guilford Railway Company, which contemplates the construction of an electric railway from Meriden to Guilford, a distance of 20 miles, has been organized and the following officers elected: Francis Atwater, Meriden, president; Joseph Merriam, Middletown, vice-president; Eugene F. Hall, Meriden, secretary, and Charles E. Jackson, Middletown, treasurer.

GIBSON CITY, ILL.—Articles of incorporation have been filed by the Drummer Telephone Company, of this city. It has an authorized

capital stock of $5,000, and among those interested are: D. A. Taylor, W. S. Day and W. E. Crone, all of Gibson City.

BLUFFTON, IND.—The Wells Construction Company has been incorporated to construct and equip an interurban electric railway from Bluffton to Geneva, and the following directors have been elected: H. C. Arnold, L. A. Williamson, L. C. Justus and S. Bauder.

Legal.

CONTRACT TO PERMIT TELEPHONE COMPANY TO TRIM TREES ALONG ITS LINE.—A landowner entered into a contract with a telephone company, permitting the company to trim the trees on his property in a certain county so as to clear the wires of the company 18 in. The agreement was written as follows: "In consideration of the sum of ($5.00) five dollars I, Peter Nachand, do hereby grant to the Cumberland Telephone & Telegraph Company, Incorporated, its successors and assigns, the right to erect, maintain and operate a line of poles and wires, and to do the necessary trimming of trees to clear wires eighteen (18) inches on and along my property in Jefferson County, State of Kentucky, and on road between Lakeland, Kentucky, and St. Mathews. Dated at St. Mathews this 16th day of August, 1909. Peter Nachand. Witness, John Lynch, Jr." After the company had trimmed the trees according to its idea of what its rights were under the agreement, the landowner brought suit for $1,000, claiming that the contract referred only to the land on which he resided, and did not include land owned by him and occupied by others. It was held that the contract could not be so construed. Under it the company had the right to trim trees on Nachand's property in Jefferson County, whether occupied by him or not. Nachand vs. Cumberland Telephone & Telegraph Company, Court of Appeals of Kentucky, 120 S. W., 319.

RIGHT TO TELEPHONE SERVICE.—Telephone companies are, to a limited extent, and yet in a strict sense, common carriers of intelligence and news, and are bound to afford equal facilities to all in like situations. They must supply all alike who are alike, and cannot discriminate against any one. Though a patron may have been delinquent, this will furnish no excuse for not restoring the service if he shall pay the amount for which he is delinquent and tender the price of service, with compliance with the reasonable rules and regulations of the company; and in a recent case it was held that, where further service was refused to a patron because he had been in the habit of annoying other patrons by interrupting their conversations and using profane language, the service should be restored upon its being shown that the patron had ceased abusing his privileges upon being warned by the company. The court summed up the rights and duties of the parties as follows: "Such a line, when used in common, enters many family circles, and the proprietor is warranted in assuming, at least until the contrary occurs, that its patrons will have regard for the ordinary amenities of life, and observe the courtesies common to civilized society. Upon discovery that in this it has been mistaken as to any subscriber, and that, notwithstanding being duly warned, he persists in the use of improper language over the line, or purposely interferes in conversations between other patrons of the system in order to annoy or interrupt their conversations, or force them to yield the line for his own convenience, and this is persisted in after being duly warned to desist therefrom, there would seem to be but one adequate remedy, and that is to withdraw the service from such person. (Jones on Teleg. & Telep., Sub. 250.) Otherwise the efficiency of the enterprise would be impaired or destroyed, and the proprietor fail in furnishing the character of service impliedly promised. The very nature of the service undertaken exacts control to this extent, for without the power to withdraw it under the circumstances mentioned, there could be no assurance of its character or efficiency. A single patron by meddling and discourtesy might deprive his neighbors of the benefits of a convenient invention and destroy the value of the property devoted to the public service. This power to regulate is essential in order to enable the defendant to perform such service, and is clearly to be implied from the nature of the enterprise. But it ought never to be arbitrarily exercised. Reasonable caution must be taken lest injustice be done. Some allowance is to be made for the infirmities of human nature. When rules to guide patrons have not been promulgated in advance, it is not unreasonable that any patron misusing his privileges be duly warned thereof by the telephone company, and given an opportunity to mend his ways before being finally deprived of this most convenient means of business and social communication." Huffman vs. Marcy Mutual Telephone Company, Supreme Court of Iowa, 121 N. W. Rep., 1033.

Personal.

MR. AVERY P. ECKERT has been appointed to the position of sales manager of the wire department of the National India Rubber Company, New York.

MR. D. B. RUSHMORE, manager of the power and mining department of the General Electric Company at Schenectady, N. Y., sailed last week for a two months' vacation in Europe, most of the time to be spent in Germany.

MR. ALFRED E. SEELIG, formerly of the electrical engineering department of Columbia University, New York, has been appointed general inspector of the Connecticut River Transmission Company, with headquarters at Fitchburg, Mass.

PROF. V. KARAPETOFF, of the electrical engineering department of Cornell University, is now connected with the Westinghouse Electric & Manufacturing Company, at East Pittsburgh, Pa., but will return to the university in the fall.

MR. FREDERICK SARGENT, of Sargent & Lundy, consulting engineers, Chicago, is in Europe, where he is studying foreign practice in the construction of electric power stations—a branch of engineering to which the firm pays particular attention.

MR. J. W. CALLAHAN has been promoted to be general manager of the Illinois Tunnel Company, Chicago, succeeding Mr. W. J. C. Kenyon, resigned. Mr. Callahan is an experienced and successful railroad man, coming from the Chicago & Western Indiana Railroad Company to the tunnel company, for which he has been successively superintendent, general superintendent and now general manager. He is highly esteemed by all who have business to do with the electric freight railways of "Underground Chicago."

MR. H. D. CRITCHFIELD has resumed his relations with the Automatic Electric Company, Chicago, acting in a general advisory capacity and also having charge of the contract department. Mr. Critchfield, who is a lawyer by training, has been a prominent figure in independent telephone development. He resigned as general counsel for the International Independent Telephone Association to return to the Automatic company, with which he was formerly connected. He says that he is firmly convinced that the use of automatic apparatus will contribute more than any other cause to the final success of independent telephony.

MR. SPENCER TRASK.—It is a matter of deep regret to the many electrical friends and acquaintances of Mr. Spencer Trask, the New York banker, to note that he has lost an eye owing to a recent automobile accident in Boston. Mr. Trask is at his summer home on Lake George, and the injured eye has been removed in order to save the sight of the other one. The accident occurred while Mr. Trask was leaving the Harvard Stadium in an automobile, which was struck by a trolley car. He was thrown forward against the glass wind screen, cutting his face and breaking his eyeglasses, and at first it was not thought that any of the injuries would be serious.

MR. WILLIAM J. C. KENYON, vice-president and general manager of the Illinois Tunnel Company, which operates the extensive system of narrow-gage electric tunnel railways underlying the central business portion of Chicago, has resigned to engage in other pursuits. Mr. Kenyon has paid especial attention to the electrical train signalling system in use in the tunnels, where the conditions are particularly difficult, owing to dampness in the concrete construction. With the co-operation of Mr. S. S. Stolp, he has devised the "Stolken" automatic electric signaling system, which is used in the tunnels with entire success. Mr. Kenyon has been with the tunnel company two years, and retired on Aug. 1.

MR. E. G. CONNETTE, who has been appointed transportation engineer by the New York Public Service Commission, is at present general manager of electric railways covering about 270 miles of track, owned by the Worcester (Mass.) Railway & Investment Company and the New England Investment & Security Company. Formerly he was general manager of the Syracuse Rapid Transit Railway Company, and was connected for a time with the Nashville Street Railway. He was born in Austin, Ind., in 1863, and has been engaged in street railway work since 1890. Mr. Connette has been active in the affairs of the American Street & Interurban Railway Association, and has contributed a number of articles to the technical press.

Obituary.

MR. WILLIAM D. McFARLAND, the well-known choral and oratorio singer, of Washington, D. C., and a brother of Mr. Walter M. McFarland, acting vice-president of the Westinghouse Electric & Manufacturing Company, died at his home in the capital July 22, following a recent serious operation at the Johns-Hopkins Hospital in Baltimore.

MR. WILLIAM WARREN LYON, JR., of New York, N. Y., an electrical engineer of the Public Service Commission, died July 30, at the home of his parents, 157 West Ninety-second Street, New York, N. Y. He graduated from Columbia University in 1906. He was a member of the Theta Xi fraternity and the American Institute of Electrical Engineers.

Trade Publications.

METAL MOLDING so flexible that it can easily be bent by hand is outlined in a folder issued by the National Metal Molding Company, Pittsburgh, Pa.

TELEPHONES.—Pamphlet No. 18 of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., is devoted to five-line combination switching telephones and two-line switching devices.

VACUUM CLEANERS.—A folder issued by the Hydro-Vacuum Machine Company, 220 E. Fouth Street, Cincinnati, Ohio, deals with motor-driven and hand-operated suction cleaners of the double-acting type.

METAL MOLDING.—A mailing card of the folder type, provided with a red paper cover of striking design, is being distributed by the National Molding Company for calling attention to its non-rusting, non-corroding metal molding.

Business Notes.

M. L. NEWMAN & COMPANY have opened offices in the Broad Exchange Building, 25 Broad Street, New York, and not at 26 Broad Street, as stated in earlier issues of this paper.

THE AUTOMATIC MANUFACTURING COMPANY, of 1945 Park Avenue, New York, has opened an attractive booth in the new Hudson Terminal station at Cortlandt Street, New York. In this are displayed the many applications of its small motors to domestic service in the kitchen.

CUTLER-HAMMER PHILADELPHIA OFFICE.—The Cutler-Hammer Manufacturing Company, Milwaukee, announces the opening of a Philadelphia office, Room 1207 Commonwealth Building, and an engineer specially qualified to advise regarding the control of electric motors will be in charge of the new office.

H. M. BYLLESBY & COMPANY, of Chicago, have moved from the American Trust Building to temporary quarters in the banking rooms at the corner of Dearborn and Monroe Streets previously occupied by the Commercial National Bank. The removal was made necessary by one of Chicago's recent bank mergers, the bank people requiring the additional space in the American Trust Building.

COAL & IRON NATIONAL BANK has been elected a full member of the New York Clearing House Association. The bank is in a most prosperous condition, and on July 15 an extra dividend of 15 per cent was declared to stockholders, who at the same time were given the privilege of subscribing to $500,000 additional capital stock at par. Every dollar of the subscription was taken. The deposits of the institution are now more than $6,000,000.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

Alabama Light & Traction Association. Secretary, Lloyd Lyon, Mobile, Ala.

American Association of Electric Motor Manufacturers. Secretary, W. H. Tapley, 29 West 39th St., New York.

American Electro-Therapeutic Association. Secretary, Dr. Albert C. Geyser, Willis Ave., New York City.

American Electro-Chemical Society. Secretary, Prof. J. W Richards, Lehigh University, South Bethlehem, Pa. Next meeting, New York City, 1909.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, Engineering Societies Building, 33 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

Arkansas Association of Public Utility Operators. Secretary, J. E. Cowles, Little Rock, Ark. Next meeting, Pine Bluff, Ark., 1910.

Association of Iron and Steel Electrical Engineers. Secretary, G. H. Winslow, 557 Frick Building Annex, Pittsburgh, Pa.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, Room 511, Harvester Building, Chicago.

American Street & Interurban Railway Accountants' Association. Secretary, H. E. Weeks, Davenport, Ia. Next meeting, Denver, Col., Oct., 1909.

American Street & Interurban Railway Engineering Association. Secretary, John W. Corning, Boston Elevated Railway Company, Boston. Next meeting, Denver, Col., Oct. 4-8, 1909.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, United Engineering Societies Building, 29 West 39th St., New York. Next meeting, Denver, Col., Oct. 4-8, 1909.

Association of Car Lighting Engineers. Secretary, G. B. Colegrove, Illinois Central Railroad, Electrical Department, Chicago. Next meeting, Chicago, Oct. 5, 6, 7 and 8, 1909.

Association of Edison Illuminating Companies. Secretary, D. L. Huntington, Spokane, Wash. Next meeting, Briarcliff Manor, N. Y., Aug. 31, Sept. 2, 1909.

Association of Electric Lighting Engineers of New England. Secretary, W. H. Cole, Waltham, Mass. Annual meetings held in Boston, third Wednesday in March.

Boston Electrical Show. Acting Secretary, Chester I. Campbell, 5 Park Square, Boston. Mechanics' Building, Nov. 15-25, 1909.

Canadian Electrical Association. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

Canadian Street Railway Association. Secretary, Allan H. Royce, 48 King St., W., Toronto, Ont.

Central Electric Railway Association. Secretary, A. L. Neereamer, Indianapolis, Ind.

Colorado Electric Light, Power & Railway Association. Secretary, J. C. Lawler, Colorado Springs, Colo. Next meeting, Denver, Oct. 7-9, 1909.

Eastern States Independent Telephone Association of Pennsylvania, New Jersey, Maryland and Delaware. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

Electric Vehicle and Central Station Association. Secretary, H. T. Sands, 139 Pleasant St., Malden, Mass.

Electric Club, Chicago. Secretary, W. S. Taussig, 204 Dearborn St., Chicago. Meets every Wednesday noon at Chicago Automobile Club.

Electric Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

Electrical Contractors' Association of State of Missouri. Secretary, Charles J. Sutter, 1220 Pine St., St. Louis, Mo.

Electrical Salesmen's Association. Secretary, Francis Raymond, 209 State St., Room 1002, Chicago. Annual meeting, Chicago, January, each year.

Electrical Trades Association of Canada. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of Chicago. Secretary, Frederick P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 4, 1909.

Electric Trades Association of Philadelphia. Secretary, E. A. Symmes, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

Empire State Gas & Electric Association. Secretary, Charles H. B. Chapin, 29 West 39th St., New York. Next meeting, New York City, October, 1909.

Florida Electric Light and Power Association. Secretary, G. F. Doig, Gainesville, Fla. Next meeting, Tampa, Fla., April 21, 1910.

Illinois State Electric Association. Secretary, H. E. Chubbuck, Peoria, Ill.

Illuminating Engineering Society. Secretary, P. S. Millar, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

Independent Electrical Contractors' Association of Greater New York. Secretary, J. W. Fluckner, 503 Fifth Ave., New York.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

Indiana Electric Light Association. Secretary, Fred. Leslie, Muncie, Ind. Next meeting, French Lick Springs, Ind., Aug. 18 and 19, 1909.

Internal Combination Engine Association. Secretary, Walter I. Sittig, 61 Ward St., Chicago.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Atlantic City, N. J., Sept. 14, 15 and 16, 1909.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

International Independent Telephone Association. Secretary, A. C. Davis.

Iowa Electric Association. Secretary, W. N. Keiser, Des Moines, Ia.

Iowa Independent Telephone Association. Secretary, W. J. Thill, 208 Des Moines Life Bldg., Des Moines, Ia. Annual meeting second Wednesday in March each year.

Iowa Street & Interurban Association. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Sioux City, April, 1910.

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Wichita, Kan., Sept. 22 and 23, 1909.

Kentucky Independent Telephone Association. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October, each year.

Maine Electrical Association. Secretary, Fred. D. Gordon, Auburn, Maine.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

Michigan Electrical Association. Secretary, A. C. Marshall, Port Huron, Mich. Next meeting, Detroit, Aug. 17, 18 and 19, 1909.

Minnesota Electrical Association. Secretary, B. W. Cowperthwait, Faribault, Minn. Next meeting, St. Paul, third week in March, 1910.

Mississippi Electric Association. Secretary, J. A. Abbott, Jackson Ry. & Light Co., Jackson, Miss.

Missouri Electric, Gas, Street Railway & Water Association. Secretary, C. L. Clary, Sikeston, Mo. Next meeting, Jefferson City, Mo., April 14, 15 and 16, 1910.

Missouri Independent Telephone Association. Secretary, G. W. Schweer, Windsor, Mo.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, John F. Gilchrist, 139 Adams St., Chicago. Headquarters, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

NATIONAL ELECTRICAL TRADES' ASSOCIATION. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster. Beatrice, Neb.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 312 Carondelet St., New Orleans, La. Meetings second and fourth Tuesday of each month.

NEW YORK ELECTRICAL SHOW. Madison Square Garden, Oct. 11-21, 1909.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. M. Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash. Next meeting, Seattle, Sept. 7, 8 and 9, 1909.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, John S. Allen, Lake Geneva, Wis. Next meeting, Milwaukee, January, 1910.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio. Next meeting, Lima, Ohio, Nov. 19 and 20, 1909.

OKLAHOMA PUBLIC UTILITIES ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla. Next meeting, Sapulpa, Okla., 1910.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, F. J. Scherrer, 195 Broadway, New York. Next meeting, Pittsburg, Pa., Aug. 17, 18 and 19, 1909.

PACIFIC COAST ELECTRIC AUTOMOBILE ASSOCIATION. Secretary, J. T. Halloran, 604 Mission St., San Francisco, Cal. Next Meeting, Oakland, Cal., February, 1910.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, E. L. Smith, Towanda, Pa. Next meeting, Eagles Mere, Pa., Sept. 8, 9 and 10, 1909.

PENNSYLVANIA STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PHILADELPHIA ELECTRICAL SHOW. First Regiment Armory, Broad and Callowhill Sts., Feb. 15-27, 1910.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Colo. Meetings second Saturday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell, Boston, Mass. Monthly meeting, fourth Monday of each month.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D. Next meeting, Jan. 11 and 12, 1910.

SOUTHWESTERN ELECTRIC & GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, care of J. G. White & Co., New York.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRIC ASSOCIATION. Secretary, A. B. Marsden, Manchester, Vt.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 125 Monroe St., Chicago, Ill. Next meeting, Detroit, Mich., Oct. 26, 27 and 28, 1909.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

WIRELESS INSTITUTE. Secretary, Sidney L. Williams, 42 Broadway, New York.

WISCONSIN ELECTRIC & INTERURBAN RAILWAY ASSOCIATION. Secretary, Dudley Montgomery, Madison, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS, ISSUED JULY 20, 1909.

[Conducted by W. F. Bissings, Patent Law, 2 Rector Street, N. Y. City.]

The patents issued July 27 were received too late for appearance in the present issue.

928,245. ELECTRICALLY CONTROLLED METER SYSTEM; H. P. Clausen, Chicago, Ill. App. filed Nov. 25, 1904. For controlling a call meter in an automatic exchange. The calling subscriber is compelled to record upon his own meter before conversing.

928,251. ELECTRIC OUTLET BOX; C. J. Dorff, Chicago, Ill. App. filed Dec. 24, 1908. The box is made in sections and is provided with two recesses in a wall to contain a lug.

928,252. CIGAR LIGHTER; C. S. Drake, Milwaukee, Wis. App. filed Jan. 23, 1909. A torch member with a reservoir of alcohol fed by a wick. An induction coil produces the spark.

928,272. SWITCH LOCKING SYSTEM FOR RAILWAYS; C. W. Nistle, North Muskegon, Mich., and Bernard W. Brady and Edward Inskip, Chicago, Ill. App. filed Jan. 2, 1908. Automatic mechanism for locking and unlocking switches at predetermined positions of the train by means of contact levers struck by the train.

928,273. BLOCK SYSTEM FOR RAILWAYS; G. W. Nistle, Muskegon, Wis., E. Inskip and B. W. Brady, Chicago, Ill. App. filed Jan. 2, 1908. Block system for railway bridges having a set of train-actuated levers associated with the track beyond each end of the bridge.

928,282. WEATHERPROOF ELECTRICAL RECEPTACLE; F. J. Russell, New York, N. Y. App. filed Aug. 20, 1908. Plug holder for lamps with a plug-receiving socket, a center plug contact in the socket and a narrow band of sheet metal within the socket secured to the wall thereof.

928,285. CONDUIT FOR ELECTRICAL WIRES; H. N. Speer, New York, N. Y. App. filed July 12, 1907. A two-ply inner tube made of one piece of material folded into two sections, each secured intermediately to the other and folded on itself.

928,287. DEVICE FOR STEADYING CURRENTS; P. H. Thomas, Montclair, N. J. App. filed Sept. 27, 1905. For securing a steady current for telautographs by means of a vapor apparatus, such as a mercury-vapor lamp, having two main electrodes and an additional positive electrode.

928,300. CABLE-OPERATED CARRIER FOR CONDUITS; W. W. Alexander and M. J. Appel, Kansas City, Mo. App. filed Jan. 18, 1906. For drawing cable through conduits. Improvement in mechanical details.

928,306. TROLLEY POLE CONTROLLING MEANS; C. E. Cozzens, Toledo, O. App. filed Dec. 16, 1908. Pneumatic control for the trolley pole.

928,307. GAS LIGHTING APPLIANCE; F. F. Dier, Manitoba, Canada. App. filed Nov. 20, 1908. Avoids matches by using a spark coil, as indicated.

928,345. ELECTRORESPONSIVE DEVICE; E. A. Terpening, Geneseo, Ill. App. filed Feb. 15, 1908. For telephone relay with horse-shoe magnets arranged about a center between which a coil is suspended.

928,360. ELECTRICAL RELAY; E. E. Clement, Washington, District of Columbia. App. filed Aug. 22, 1906. Telephone relay for exchanges for making and breaking a plurality of contacts, the latter being self adjusting.

928,371. SIGNALING BY ELECTROMAGNETIC WAVES; R. A. Fessenden, Washington, D. C. App. filed May 4, 1906. Interference preventer, with an inductive connection having a variable primary, a condenser, a detector connected with the secondary of the inductive connection, a condenser shunting with the primary, a variable inductance and antenna.

928,394. RHEOSTAT; C. R. Meston and H. I. Finch, St. Louis, Mo. App. filed April 23, 1909. A rheostat having a recess in its base with resistance wire wound on movable perforated plates, the latter in the recess.

928,396. BLOCK SIGNALING SYSTEM; D. J. McCarthy, Wilkinsburg, Pa. App. filed Jan. 29, 1909. Signaling means for indicating the condition of two blocks with a three-position relay for controlling a signaling means. The device is energized by alternating current.

928,402. CONTROLLING MEANS FOR ELECTRIC HEATERS; E. H. Richardson, Ontarion F. Booth, Alhambra, and W. Meredith, San Francisco, Cal. App. filed April 16, 1908. For electric laundry irons. Automatically moves a connection plug out of contact with the terminals to prevent excessive heating.

928,428. CABLE TERMINAL; F. B. Cook, Chicago, Ill. App. filed March 1, 1909. A base, sheet-metal sides on the base and a channel iron located between the sides to accommodate the cable conductors.

928,431. GUARD FOR TELEGRAPH AND TELEPHONE WIRES; C. J. Elliott, Oxnard, Cal. App. filed June 4, 1908. For high-tension wires to keep them from coming into contact with telegraph wires by means of a guard frame supporting the wire away from the pole, the frame being rounded.

928,438. SINGLE-PHASE COMMUTATOR MOTOR; V. A. Fynn, Blackheath, London, England. App. filed March 3, 1906. A single-phase commutator motor having a main winding on the inducing member consisting of two parts connecting in series, an auxiliary winding thereon; an induced member, an auxiliary e.m.f introduced therein with means for short circuiting the induced member along one axis.

928,442. TROLLEY BASE; C. E. Gierding, Newark, N. J. App. filed Aug. 14, 1908. A trolley base with a cushion stop. Details.

928,464. ARC LAMP; D. S. Knapp and I. S. Schlesinger, Philadelphia, Pa. App. filed July 17, 1907. Improvement in the construction of the top carbon holder for a flaming arc lamp.

928,474. ADAPTER; H. S. Salt, New York, N. Y. App. filed April 14, 1908. For use with tungsten lamps which have to be supported vertically in a fixture where the lamps ordinarily project horizontally.

928,476. PROCESS OF MANUFACTURING SILICON NITRID; A. Sinding-Larsen, Christiana, Norway. App. filed May 17, 1909. Produces vapors of silicon by heating a silcid and causing the same to be acted upon by gaseous nitrogen in heated condition.

928,482. CLUTCH FOR WINDING DRUMS OF HOISTING MACHINERY; C. P. Turner, Harrisburg, Pa. App. filed Feb. 1, 1908. Improvement in the mechanical parts of electrically driven hoisting drum.

928,483. PORTABLE BANK; B. S. Wakeman, Scranton, Pa. App. filed Sept. 22, 1908. Savings bank in which access to the bank is prevented by an electromagnet whose armature controls the locking bolt; operated by a magnet from the outside, which magnet is kept at the bank.

928,505. GAS-LIGHTING APPLIANCE; F. F. Dier and M. Primeau, Winnipeg, Canada. App. filed Jan. 9, 1909. A battery and helix with a hand instrument including two extending members to close the circuit.

928,510. LIFTING MAGNET; A. C. Eastwood, Cleveland, Ohio. App. filed Aug. 10, 1908. Has an annular winding space, a unit for the space comprising a bottom plate for closing it and a winding clamped to the upper side of the bottom plate.

928,516. ELECTROMAGNETICALLY OPERATED APPARATUS; R. E. Hellmund, Hinsdale, Ill. App. filed April 4, 1906. An S-shaped armature for an electromagnet.

928,521. ELECTRIC METER; D. C. Jackson, Madison, Wis. App. filed Sept. 14, 1904. Mercury type watt-hour meter in which the self inductance of the pressure coil is neutralized.

928,531. FREQUENCY RELAY; D. J. McCarthy, Wilkinsburg, Pa. App. filed April 24, 1907. For use with two or more alternating currents of different frequency, having two windings of substantially equal inductance, a movable element subjected to their combined influences, one of the windings being resonant at a predetermined frequency.

928,532. ELECTRIC IRON; D. W. McClay, Pittsfield, Mass. App. filed April 10, 1908. An iron provided with a multiple coil, single heating unit, the coils in series, and having a core to allow for expansion.

928,547. ELECTRIC STARTING DEVICE; J. L. Schureman, Chicago, Ill. App. filed Sept. 20, 1907. For controlling the current through an electric motor by means of a series of switches and cams on a rotatable shaft arranged to engage successively the switches and close them.

928,570. SELECTIVE SIGNALING DEVICE FOR RAILWAYS; S. R. Wright, Rochester, N. Y. App. filed Aug. 24, 1908. A line wire with instruments in series connected therein, a controlling selector at the operating station, provided with a variable contact which may be positioned at will by the operator.

928,571. RAILWAY SELECTIVE APPARATUS; S. R. Wright and C. L. Diehle, Rochester, N. Y. App. filed Aug. 24, 1908. The master selector comprises a motor and a movable switch actuated thereby when the condition of the electromagnet changes. A series of local selectors driven by a motor are controlled by the master selector.

928,572. ADVERTISING SHADE FOR INCANDESCENT LAMPS; John D. Yongh, New York, N. Y. App. filed March 26, 1906. A shade for advertising, consisting of thin, flexible material provided with a projection detachably clamped between a screw-threaded projection of the lamp and its socket.

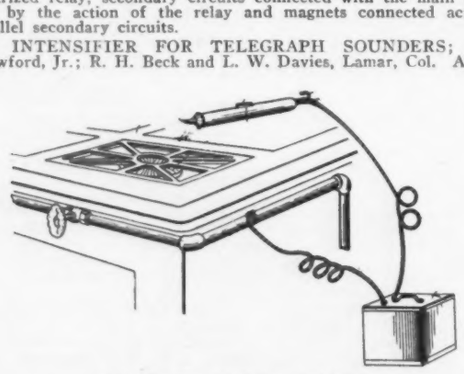
928,580. PROCESS FOR PRODUCING INCANDESCENT MANTLES; G. Byhlmann, Gross-Lichterfelde, Germany. App. filed March 8, 1907. Dissolves a rare earth metal salt, add ammonia, dissolves the precipitate, forms a saturated solution and dips the mantle therein.

928,581. TELEGRAPHIC TYPEWRITER; E. Burlingame, La Porte, Ind. App. filed April 26, 1906. A plurality of sliding bars, a plurality of armatures, one for each character, a magnet for actuating them, and a relay for releasing the magnet after printing.

928,582. POLARIZED MAGNET; E. A. Burlingame, San Francisco, Cal. App. filed May 11, 1908. A permanent horseshoe magnet with a magnet coil between the shoes, an armature located between the core and the poles and arms pivotally connecting the armature with the base.

928,583. METHOD OF UNIDIRECTING ELECTRIC CURRENTS; E. A. Burlingame, San Francisco, Cal. App. filed Nov. 11, 1908. Polarized relay, secondary circuits connected with the main line circuit by the action of the relay and magnets connected across the parallel secondary circuits.

928,589. INTENSIFIER FOR TELEGRAPH SOUNDERS; R. W. Crawford, Jr.; R. H. Beck and L. W. Davies, Lamar, Col. App. filed



928,307—Gas Lighting Appliance.

Nov. 3, 1908. For telegraph relays. Provides the relay with a sound box, a stylus arm engaging a diaphragm and a horn.

928,592. MACHINE FOR APPLYING TAPE TO ARMATURE COILS; J. S. Downs, Easton, Pa. App. filed Aug. 26, 1908. For winding armatures by means of annular tape-carrier having a gate permitting access to the interior of the carrier.

928,597. MUTIPLE PENDANT SWITCH; C. D. Gervin, New York, N. Y. App. filed Jan. 17, 1908. An insulating base, plungers movable therethrough to engage a terminal, spring clips holding the plungers and a release button to displace the clips.

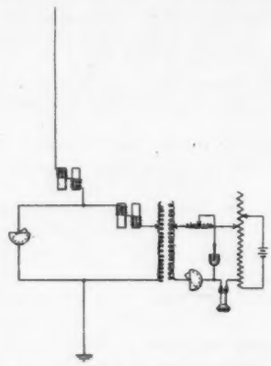
928,651. SOUND-PRODUCING INSTRUMENT; F. Gottschalk, New York, N. Y. App. filed Dec. 23, 1907. A telephone transmitter having a casing with an aperture, a diaphragm therein and a receiver cup extending from the diaphragm to the aperture.

928,652. RESISTANCE CUP; F. Gottschalk, New York, N. Y. App. filed June 3, 1908. A carbon-receiving cup for telephones having a series of partitions of insulating material separating the granules.

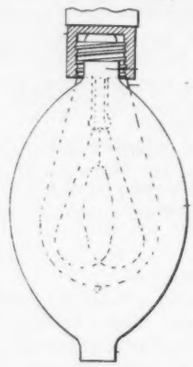
928,668. TROLLEY; F. Kompe, Berlin, Germany. App. filed Oct. 10, 1908. A screw-shaped groove is provided on the trolley roller to assist in finding the wire.

928,680. TELEPHONE SYSTEM; D. W. May, Kansas City, Mo. App. filed May 18, 1908. Common battery system in which a line selecting switch is adapted for intermittent operation and is actuated by the removal of the telephone receiver. Central may also effect the operation of the switch.

928,701. UNITING THE COMPONENT PARTS OF COMPOSITE SHEET-METAL STRUCTURES; A. F. Rietzel, Lynn, Mass. App.



928,371—Signaling by Electromagnetic Waves.



928,572 — Advertising Shade for Incandescent Lamps.

filed Feb. 24, 1905. Electrically welds the metal at spots by the application of pressure and heating current localized in the spots.

928,707. CONTROLLER; H. Smith, Suffern, N. Y. App. filed Aug. 8, 1908. A revoluble drum carries resistance windings which dip into a body of mercury.

928,709. INSULATOR FOR THIRD RAILS; Louis Steinberger, New York, N. Y. App. filed Feb. 2, 1909. The bearing member is supported by the base and locked thereto, and a body of insulation on the bearing member carries the rail.

928,734. PROCESS FOR ELECTROLYSIS OF ALKALI CHLORIDS; J. Billitzer, Vienna, Austria-Hungary. App. filed Jan. 22, 1907. Forms a thin layer about the cathode and constantly removes it as formed.

928,763. INSULATING JOINT; C. A. Jaynes, East Orange, N. J. App. filed May 8, 1908. For gas pipes having insulated members riveted together and a socket member to which the insulating members are secured.

928,771. DYNAMO-ELECTRIC MACHINE; F. R. Kunkel, Edgewood Park, Pa. App. filed Jan. 10, 1908. Spherical bearing sleeves for the armature and a sheet-metal casing for the machine, having hemispherical sockets for the bearings.

928,772. PIVOTAL CONNECTION; F. R. Kunkel, Edgewood Park, Pa. App. filed Jan. 10, 1908. For fan motors in which a number of space projections are embraced by a plurality of nested U-shaped clips clamped together.

928,799. DYNAMO-ELECTRIC MACHINE; H. M. Schiebe, Wilkinsburg, Pa. App. filed Jan. 10, 1908. The machine may readily be taken apart and has terminal devices, an end bracket and brush holders carried thereby.

928,824. CIRCUIT CLOSER; O. M. Tustison, Bainbridge, Ind. App. filed June 30, 1908. A circuit closer for automobiles which can be operated only by the owner's key.

928,826. UNDERGROUND CONDUIT; S. B. Way and E. C. Freeze, St. Louis, Mo. App. filed Aug. 19, 1907. Concrete conduit made in sections.

928,839. TROLLEY SWITCH PLATE; E. Bell, Dunbar, Pa. App. filed Dec. 26, 1908. A trolley switch having inverted V-shaped converging grooves and V-shaped conductors in the apex of the grooves.

928,844. MANUFACTURE, CONCENTRATION AND SIMULTANEOUS PURIFICATION OF SUFURIC ACID; G. C. DeBriailles, Paris, France. App. filed Oct. 30, 1908. Makes sulfuric acid by oxidizing sulfurous acid through electrolysis.

928,857. ELECTRIC ARC LAMP; S. E. Donnelly, Shreveport, La. App. filed Jan. 16, 1909. For fixing an electrode to the holder body by means of a special clamp so that expansion by heat will not loosen the electrode.

928,862. TELEPHONIC APPARATUS; E. A. Graham, Brockley, London, England. App. filed Oct. 7, 1907. Comprises a casing, a watertight door with circuit-controlling switch operated from the outside of the casing and an agitating device for shaking the carbon granules, also operated from the outside of the casing.

928,879. TROLLEY POLE FOR ELECTRIC RAILWAY CARS; T. Oliver, dec'd, Chicago, Ill. App. filed June 30, 1908. The pivoted trolley pole is automatically dropped when the pole rises above its normal range of movement by means of an arrangement of spring and detent.

928,888. PROCESS FOR EXAMINING MATTER OR OBJECTS IN QUANTITIES; J. I. Solomon, New York, N. Y. App. filed Nov. 25, 1907. Particularly for examining pearl oysters without injuring them by supporting them on a tray and subjecting them to X-rays.

928,901. AUTOMATIC CIRCUIT BREAKER; H. W. Cheney, Norwood, Ohio. App. filed Oct. 22, 1906. An oil switch for any number of phases having a rotary switch member or drum, a weight on the drum for opening the switch and an operating handle for closing it.

928,918. COMMUTATOR FOR ELECTRICAL MACHINES; F. R. Kunkel, Edgewood Park, Pa. App. filed Oct. 7, 1908. Conducting segments with dove-tailed projections, insulating collars embracing them, reinforcing disks for the collars and a supporting sleeve for the parts.